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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

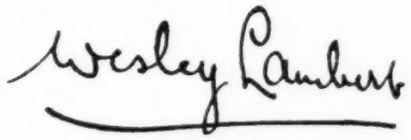
MAY-OCTOBER.
North-East Coast Exhibition at Newcastle-on-Tyne.

JULY 2-4.
North-East Coast Institution of Engineers and Shipbuilders:—Joint summer meeting with the Institution of Shipbuilders in Scotland, at Newcastle-on-Tyne.

JULY 16-27.
International Aero Exhibition at Olympia, London, W.

A Message from the President.

When replying to the toast of the Institute of British Foundrymen, so graciously proposed by Sir John Dewrance, I expressed its indebtedness to the various authorities, committees, companies and individuals for the help they gave towards making the International Congress the success it undoubtedly was. The Editor has afforded me a second opportunity of renewing those thanks, and of communicating to the foundry industry, wherever it be located, a message of goodwill. Foundrymen as well as politicians are cognisant of the "pendulum effect," and it is patent to everybody connected with the Institute of British Foundrymen that this Congress has both awakened dormant interests and created new ones. At the moment it carries the hall-mark of success, and with success comes a testing time. Thus, my first message to the industry is to avoid at all costs any backward swing of the pendulum. Though the international activities may remain static for a few years, yet there is ample work for all of us in advancing the technique of our industry, by co-operative effort through our scientific and technical associations. I suggest that, wherever possible, the basic character of the industry should be stressed; its underlying scientific principles emphasised; its craftsmanship and historical development clearly defined. There is much work yet to be done in the systematic recruitment and training of the personnel of the foundry, whether they be juvenile or adult entrants. Finally, the contacts made during the last few weeks must be welded. Europeans will learn that their newly-found American friends are efficient and courteous correspondents, therefore a special effort should be made to carry out those conversational promises made. Courtesies of this character are invariably reciprocal and are conducive to all that is best in international amity and business.



As Others See Us.—II.

The Convention has come and gone, and it has duly provided us with opportunities for establishing contacts with our foreign friends and thereby estimating how far we were right in our prophecies of their impressions. We were, in the first place, perfectly correct when we suggested that to those who know Great Britain, Germany, and the United States, the most striking differences are rather between our own country and America than between us and Germany. This fact, coupled with the size of the American delegation, accounts for the predominance of the American point of view and the American comment. Our visitors from the other side of the Atlantic were, for instance, much impressed by the fact that British foundries carry a comparatively large labour force for their output. This is, of course, a well-known fact, and it is inevitable where wage-rates are lower. It is not necessarily a ground for criticism, however, for the true criterion of efficiency is price, and there was ample and repeated evidence that in many foundry products the price of a given article is higher in America than it is here, so that from this test we emerge triumphant. Whether the average British foundry carries more staff than the average American foundry was disputed. The general view tended towards the impression that our foundry laboratories are more generously staffed than those in America, but it is worth noting that the foundries selected for display to visitors are naturally the more efficient, and hence may be considered a little above the average in these matters. Let us add here that the opinion was freely expressed that so far as certain of the visits were concerned nothing in America could outdo them in general efficiency and enterprise. We were also justified in our suggestion that comment would be aroused by our lack of specialisation, and also by the degree of attention paid to finish. The view was even expressed that our foundries spend too much time on attention to unimportant details of finish. At the same time, our visitors were much impressed by the high standard of our foundry craftsmanship, admitting their own lack of anything comparable, and by the high degree of finish in the work resulting from our good natural moulding sands.

The outstanding feature of the exhibition to these same visitors seems to have been the Technical Exhibit, by which they were very much impressed. They lamented the inability of founders in the States to produce anything comparable in the past, and they freely admitted that we are doing more than they in the way of investigation and research. At the same time, we must in fairness remind ourselves of the recently formed Grey Iron Institute over there—a co-operative effort by the manufacturers, on commercial lines, designed to meet the competition of malleable steel, etc., to prevent overlapping, and, in fact, to cover the whole field of the industry except questions of wages and prices. It would appear that in these matters there are lessons to be learnt on both sides.

In due course we shall, no doubt, learn the considered views of our visitors on the business side of the trip; but the outstanding thing during the actual course of the Convention was the evident impression made upon them by the social side of the trip, and their appreciation of our landscape, our traditions, and our hospitality, a fact which must be peculiarly gratifying to those responsible for the organisation of the Convention.

Feeding the Foundry.

Scrap Reservoirs Filling Up.

By a Metal Merchant.

Whilst the iron and steel trade is suffering from a distinct shortage of scrap, due to the big prices paid by manufacturers on the Continent, who have been only too glad to pick up British material, the slump in copper has brought about a state of semi-stagnation in the non-ferrous metal trades and compelled a temporary hold-up in the distribution of old metals.

A visit to the metal sheds of one of the big railway stations at present shows very clearly that consumers of scrap are not taking delivery of this material as quickly as the dealers are accumulating it, for on every side are stacks of metal, some sheeted against the weather, while others are open to every wind that blows.

At a time like the present, when scrap is accumulating, one discovers an endless variety of material, and to anyone unaccustomed to dealing in old metals the casual way in which parcels are dumped down and apparently forgotten seems amazing. One is speedily undeceived, however, if one tries to walk out of the station gates with a sample of one's own metal, unless equipped with a "pass" from the office, for politely, but firmly, the man on duty there will hold up anyone pending an inquiry. Every parcel has a "pro" number, and the yardmen know just where the stuff is to be found. What is more, they are no mean experts in the gentle art of sizing up the merits of the material under their charge.

At certain well-known metal sheds in the Midlands the yawning mouth of a tunnel makes a not unsuitable background to a scene of semi-desolation. Although this goods station lies in the heart of a great city, grass grows wherever it can gain a foothold, and even wild flowers of the more hardy type may be seen. It cannot be called a restful place, for all day long the drays are coming and going, while from time to time the crash of shunting trucks drowns all other noise, and the ceaseless activity of a huge overhead crane seems to symbolise the spirit of work dominating the whole place.

London Scrap.

Near the tunnel mouth, from which the smoke eddies in choking drifts, stands an array of casks filled with low-grade metal designated by the somewhat high-sounding title of "London scrap."

In other places are stacks of condenser tubes considered good enough for re-drawing, which, after faithful service aboard a battleship or cargo boat, are doomed to suffer the torture of the rack on the drawbench. Should tests show them to be too badly corroded or spoiled by hard scale, an even worse fate awaits them in the melting pot! Here is copper wire scrap of every conceivable gauge from "hair" to thick stuff good enough to cut up as makeweight for the brass foundry, while rubbing shoulders with it are some heavy concave copper plates heavily corroded, which in an earlier existence were united to make a brewery vat. Stacked "man high" are hundreds of bags of brass swarf bursting open at many a corner and allowing a trickle of yellow dust to pour on to the ground. Somebody will have to own a short weight when this parcel goes out, unless, of course, the station is able to conjure up a spare bag or two from its unofficial store, which had no beginning and presumably will have no end as long as trading in scrap metals endures.

Grey Iron.—In the party of American foundrymen who attended the Third International Foundrymen's Congress in London is included a committee of three members of the Board of Directors of the Grey Iron Institute, who will study various methods employed in the manufacture of grey-iron castings in the leading European countries. The Grey Iron Institute Committee was headed by Vice-President A. E. Hageboeck.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

British Perlit and Emmel Licensees' Association.

To the Editor of The Foundry Trade Journal.

Sir,—It has been asked what are the functions, activities and value of the above Association, Its functions are to explore the theoretical, practical and commercial problems and possibilities of iron-foundry practice, of cast irons of all qualities, and of Perlit and Emmel cast irons in particular. Its activities consist of two-day meetings held four or five times yearly at the works of one or the other of the licensees and attended by the chief metallurgists, the foundry managers and the head foremen of all the British licensees. Its value may be assessed from the fact that three years ago we began with one-day meetings, and have been compelled to extend them to two days because of the immense volume of work which has to be considered. It has been said that membership of this Association alone makes Perlit worth while, because it results in such an improvement in the whole of one's practice.

Although I have no connection with Perlit, I am manager and secretary of the Association, perhaps because I was the first in this country to manufacture it at the North-Eastern Marine Engineering Company.

My attention has been drawn to your description of the Association's exhibit at the Foundry Trades Exhibition, where you stated that Mr. F. G. Martin, Mr. G. Hall and myself were in attendance. The facts are that five licensees participated in the exhibit, and their representatives took charge in turn. Those licensees were:—W. H. Allen, Sons & Company, Limited, Bedford; J. & E. Hall, Limited, Dartford; Jenkins Bros., Limited, Birkenhead; The North-Eastern Marine Engineering Company, Limited, Wallsend-on-Tyne, and Vickers-Armstrongs, Limited, Barrow-in-Furness, and I shall be glad if you will very kindly correct through the medium of your columns any misapprehension which may have arisen from your original announcement.—I am, yours, etc.,

Horace J. Young.

3, Central Buildings, Westminster, S.W.1.
June 17, 1929.

The Steel and Rail Cartels.

April 30 was the last day for giving notice to determine the agreement of the groups participating in the Continental Steel Cartel, in which event the Cartel would expire on October 31, but no such notice was given to the managing committee by any one of the groups. On the other hand, the Committee have received demands from all the groups, which are put forward as conditions for their continued membership of the Cartel. These demands, which are not considered to be in the form of ultimatums, were discussed at the meeting held in Paris last Tuesday (June 18).

On the following day the representatives of the Irma (International Rail Makers' Association) assembled in the same city, when the question of prices came forward for discussion. It was thought that a slight increase would be made, especially as the costs of production have risen in the Continental countries through the advances in wages and dearer fuel since the last price-fixing took place. Since November 1, 1928, the price for basic quality has been £6 10s. per ton f.o.b., while the present rate for open-hearth quality is £6 17s. 6d., although German works are said to have recently sold open-hearth rails at £7 per ton.

An order for 20,000 tons of rails and accessories is reported to have been booked by France from Bulgaria, which tonnage will be charged to the account of the French group in the Irma.

Random Shots.

The first thing that comes to my mind as I sit down to set on paper my impressions of the London Convention that has just come to so successful a conclusion, is the very large attendance, and the big proportion of ladies present. Usually they are in all too small a minority, but this time, perhaps on account of the attractions of London as a conference milieu, there were nearly enough of them to go round—and that, on a social occasion of the kind, is a very large contributor to its success.

* * *

It was also most interesting to find that in addition to India, Canada and Australia, there were no less than twelve countries represented—France, Belgium, the United States, Germany, Italy, Holland, Czecho-Slovakia, Poland, Spain, Denmark, Luxemburg and Russia. The Russian visitor aroused a good deal of interest, and he was described in one of our popular contemporaries as "the Man with Millions to Spend." He was M. Koniukhov, president of the Machinery Syndicate of Russia, which is the Soviet Government Department that equips Russian manufacturers with whatever machinery they need.

* * *

One could not help being struck by the ease with which the delegates from the Continent managed the language question. Even those who had never been in England before spoke more than passable English, and this confirmed me in my impression that we in this country are extremely backward in the matter of language teaching. The only consolation is that to judge by the experience of the present occasion our American cousins are still more backward. It is too much to suggest that they seem to have a touching faith in the power of the American film to teach American as she is spoke to the whole civilised world?

* * *

The comments of our American friends were many and interesting. Apparently the average American visitor on his first trip to England expects to find the railway line from Southampton to London bordered with an endless row of houses, and when they find how much of our rural landscape still remains—and thank heaven for it, say I—they wonder why we grow so small a proportion of our own foodstuffs. They are also invariably impressed by the English tradition of ceremony and pageantry. This is apt at times to strike the visitor as a trifle theatrical, but in the present instance it became a real and personal thing through the reception in the Guildhall. The fact that they were watching the doing of things that had been done in the same place and in the same way for centuries seemed to strike them especially, and we might do worse than take the matter to heart and abandon for a moment the complacence with which we are inclined to accept the peculiar charms of our country and our way of life.

* * *

I heard a good story the other day of a man who got into a railway carriage with one occupant, and startled the said occupant by drawing a revolver. "What on earth is the matter?" he asked. "I always said," the newcomer replied, "that if I met a man uglier than myself I'd shoot him." "Am I really uglier than you?" "You are," was the convinced reply. "Then shoot away!"

Marksman.

The Elimination of Sulphur from the Alloys of Iron.*

By K. Gierdziejewski, Met. Eng.

(Manager of the "Ursus" Foundries, Warsaw, Lecturer at the Warsaw Polytechnic.)

[POLISH EXCHANGE PAPER.]

Sulphur is the most detrimental impurity in iron, and its elimination is extremely difficult, primarily on account of its great affinity for iron. The prejudicial effects of sulphur are evidenced by the lowering of mechanical properties as well as by a deterioration in casting properties (reduced fluidity and greater contraction), and, generally speaking, from the physical point of view—brittleness of the iron, especially at higher temperatures, and so forth. The limiting amount of sulphur that can be tolerated depends on the quality of the metal: for ordinary cast iron the maximum permissible contents is 0.15 per cent.; for steel and wrought iron 0.05 per cent., but even these amounts are detrimental.

Sulphur enters cast iron from the pig and the coke. Because of the presence of sulphur in coke, when cast iron is produced by the remelting of pig-iron in a cupola, its content is raised by 40 to 50 per cent. If the charge contains large quantities of bought scrap it is possible to obtain a very high sulphur content. During the production of steel in the open-hearth furnace it can also be observed that there is an increase in the sulphur content due to furnace gases, but metallurgical processes, especially in basic-lined furnaces, make it possible to reduce the sulphur to 0.03-0.02 per cent. in the finished metal. The ideal conditions for the maximum practical elimination of sulphur are to be associated with the electric-furnace process.

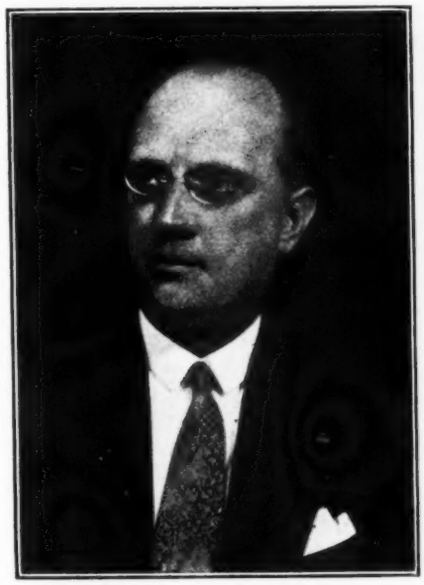
Sulphur forms the following compounds with iron and manganese:—(*a*) Iron sulphide, FeS, which has a melting point of 1,200 deg. C.; (*b*) manganese sulphide, MnS, with a melting point of 1,620 deg. C.; (*c*) iron-manganese-sulphide eutectic (93 per cent. FeS+7 per cent. MnS), which has a melting point of 1,181 deg. C.; and (*d*) iron-iron sulphide eutectic (85 per cent. FeS+15 per cent. Fe), with a melting point of 980 deg. C.

Iron sulphide is very easily dissolved in molten metal, whilst manganese sulphide shows the reverse phenomenon, and since it has a low specific gravity (3.8-4.0), it rises easily to the surface of the metal bath and thus can readily be eliminated with the slag.

The desulphurisation of the bath is based on this property, therefore the best conditions for allowing the reaction, FeS+Mn=MnS+Fe, to take place, must be determined. Prof. Grum-Grzymajlo† has studied these conditions systematically, founding his arguments on physico-chemical and thermo-chemical data. The author proposes to expound a similar treatment.

Desulphurisation of the Bath by Cooling.

This method is based on the following exothermic reaction — FeS+Mn⇌MnS+Fe+44,101 calories, which, according to Le Chatelier's law, can only take place in a cooling bath. Desulphurisation in non-heated metal-mixers follows this law, since, as the bath of metal cools, the above-mentioned reaction takes place in the direction of the upper arrow and the manganese sulphide formed enters the slag. In ordinary cast-iron foundry practice this method cannot be generally employed, since a metal cooled for too long will be unable to fill the moulds. When the cupola is operated in such a way that the metal reaches a high temperature, it is possible to allow the metal to cool slightly, say, down to 1,350 deg. C., but the resulting desulphurisation is only partial and insignificant. When the metal is to be blown in a converter it is also important that it should have a high temperature, therefore cooling is not recommended, so it is only when producing steel with an open-hearth furnace that a preliminary cooling of the metal in the mixer is possible and even necessary. When the manganese content and the temperature of the bath are correct, it is possible to remove 75 per cent. of the total sulphur by this method.



K. GIERDZIEJEWSKI, MET. ENG.

Desulphurisation using Higher Contents of Mn in the Metal and in the Slag.

This method is based on the following well-known law of solutions: "When to two immiscible solutions (such as the metal and the slag) a solvent, which is soluble in both solutions, is added (FeS and MnS), this solvent divides itself between the two solutions in such a manner that its proportional concentration in the two solutions is constant." In other words,

$$\frac{\text{FeS.MnS in the slag}}{\text{FeS.MnS in the metal}} = \text{K (constant)}.$$

The best results are obtained when K is at a maximum, that is to say, when the MnS and FeS content of the slag is at a maximum; metallurgy postulates that the maximum solubility of sulphides in slags is obtained when the slags contain large amounts of the oxides of the same elements, in this case MnO and FeO. Therefore it would appear that it is to be recommended that the slags contain a maximum amount of these oxides.

Under the conditions existent in the cupola, it is possible to raise the MnO and FeO contents in the following manners: (1) Raise the amount of manganese in the charge; (2) introduce into the charge a manganese-rich flux (such as manganese ore or manganese-rich slags), and (3) by the use of basic slags.

By increasing the amount of manganese in the charge and by conducting the melting operation at a high temperature and in the presence of an excess of oxygen, a greater loss of manganese is obtained which under the form of manganese oxide passes into the slag and facilitates desulphurisation. The same refers to iron. The advantages of using charges running high in manganese cannot be questioned, therefore the use of high-manganese pig should be strongly recommended, and especially that of the quality employed for open-hearth steel furnaces. The author has personally more than once had proof of the advantageous effect of an increased Mn-content in the charge, and strongly advises that selection should be made in such a manner as to obtain a minimum of 0.7 per cent. Mn in the cast metal. Besides this, the cast iron run from the cupola should be sufficiently hot to be able to stand for a time in order that the exothermic reaction, FeS+Mn=MnS+Fe, may take place under the most favourable conditions.

In 1902 Reusch* tried out the effect of the introduction of high-manganese fluxes into the cupola; technically the results were fairly good, but the process was too costly. Further experiments by Wedemeyer,† Wüst,‡ and others showed that this method was not practicable, for in order to melt this surplus of flux it was necessary to increase the coke in the charge, and by this very fact increase the contamination of the metal with sulphur.

In Stahl and Eisen, 1925, page 197, there is note to the effect that the Gütehoffnungshütte works are employing, on a large scale, the desulphurisation of cast iron by means of open-hearth steel slags; the economy of such a procedure can only be explained by exceptional local conditions.

Desulphurisation by means of Basic Slags.

This method and the former one are based on the same theoretical facts. From the formula cited one can postulate:

FeS.MnS in slag=FeS.MnS in metal X "K," that is to say that the concentration of FeS.MnS in the metal can be brought down to zero when the concentration of FeS.MnS in the slag is made to approach zero. The latter can be obtained by replacing FeS and MnS by other sulphides which are not soluble in the metal, such as, for instance, CaS or MgS. Calcium sulphide is not soluble in the metal, therefore, from the above considerations, it follows that its use also tends to the elimination of sulphur.

In practice, however, complete desulphurisation by this method is not feasible, since the thermal reactions—

MnS+CaO=MnO+CaS−13,481 cal. ..... (1)
FeS+CaO=FeO+CaS−6,573 cal. ..... (2)

are not of great intensity.

The reaction expressed by formula (1) explains why it is that desulphurisation is best effected when the temperature of the furnace is high, since this produces the best conditions for this endothermic reaction.

Everyday practice entirely proves the correctness of the above theoretical conclusions. J. W. Bolton,§ in his very explicit article developed on the subject of cupola slags, shows diagrams giving the relation between the percentage of CaO+FeO in the slag and the degree of desulphurisation, taking the total sulphur contents of the bath as being 100 per cent. One of these diagrams is reproduced in Fig. 1. From this diagram one can gather that the best desulphurisation is obtained when using a slag running to 35 to 45 per cent. total CaO+FeO contents. Bolton points out that a slag of this composition possesses, to a great degree, the quality of forming what is called "slag-wool" when expelled from the cupola, and since his experiments show that this "wool" usually contains more sulphur than the slag, desulphurisation is greatly enhanced. R. Spodlers and F. Schulte‖ also support this opinion.

However, complete desulphurisation cannot be effected by this method, since very basic slags are not easily melted, and require, in the cupola, additional fuel, which will introduce more

* A Paper presented to the International Foundrymen's Congress.
† Prof. Grum-Grzymajlo, "Manufacture of Steel," 1925, page 209.

* Stahl und Eisen, 1902, page 415.
† Stahl und Eisen, 1903, page 1134.
‡ Stahl und Eisen, 1904, page 1316.
§ "The Foundry," 1921, page 675.
‖ "Die Giesserei," 1924, page 281.

sulphur, whilst in the converter and open-hearth processes they cause practical difficulties which do not enable one to reduce the sulphur contents to less than 0.03 per cent. in the finished metal.

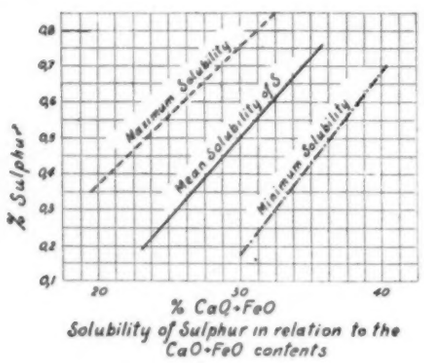
It should here be noted that in recent literature relating to foundry practice it has many times been mentioned that calcium-fluoride, CaF_2, favours desulphurisation. This is easy to explain, since the addition of fluorspar greatly increases the fluidity of slags, or, in other words, enables one to run on more basic slags, the effect of which on desulphurisation has just been discussed.

Electric furnaces present the best conditions for desulphurisation with basic slags, since (1) it is possible to conduct the whole process at very high temperatures, and (2) the atmosphere of the furnace is neutral and not oxidising. Under these conditions it is possible to keep up the reactions in the presence of carbon.

$FeS+CaO+C=CaS+Fe+CO-30{,}710$ cal. ... (3)

$MnS+CaO+C=CaS+Mn+CO-74{,}811$ cal.... (4)

These reactions are intense in the presence of the high temperature of the electric furnace,



Solubility of Sulphur in relation to the CaO+FeO contents

FIG. 1.

and since CaS is not soluble in the metal, it is possible almost completely to desulphurise the metal. The slag thus obtained has approximately the following analysis: $SiO_2=31$; $CaO+MgO=60.5$; $FeO+MnO=3.5$; and $S=0.15$ per cent., the sulphur content in the metal being 0.008 per cent.

In iron foundries there has been of late an increasing use of the alkali metal compounds, especially those of sodium, for desulphurising. Since in the first place, at the temperature of the molten bath, sodium carbonate is decomposed into the oxide of sodium and carbon dioxide, the reactions which take place afterwards can be summarised in the following formulæ:—

$Na_2O+FeS=Na_2S+FeO+36{,}313$ cal... .. (5)

$Na_2S+2FeO=2Na+2Fe+SO_2-153{,}466$ cal. (6)

$Na+FeO=Na_2O+Fe+34{,}187$ cal. .. .. (7)

Similar reactions also take place with manganese.

In the presence of the silica contained in the slag, the following reactions also take place:—

$Na_2O+SiO_2=Na_2O.SiO_2+45{,}200$ cal. .. .. (8)

$Na_2S+FeO+SiO_2=Na_2O.SiO_2+FeS+8{,}887$ cal. (9)

These latter reactions can actually cause the return of part of the sulphur into the metal.

For all practical purposes, Walter solved the problem by marketing desulphurising briquettes the composition of which is such that if added to the extent of 0.5 per cent. by weight to the charge, it is possible to obtain a total reduction of 80 per cent. of the sulphur in the cast iron.*

Effective desulphurisation is only obtained if the "desulphurising medium" does not come into contact with the slag containing SiO_2. For this reason the medium should not be added through the charging door. The elimination of sulphur in the ladle also does not give good results on account of the large quantities of sulphur dioxide which are evolved, contaminating the atmosphere, and on account of the slag which is always present in the ladle.

At the present the best means of overcoming these difficulties is to employ cupolas of a special design with a slag reservoir, patented by C. Rein, in conjunction with a Durkopp-Leyken overflow arrangement. In a cupola so designed the slag and the metal are separated in the furnace so that only clean iron reaches the mixer, the slag being collected in Rein's lateral reservoir.

The desulphurising medium is added to the metal in the mixer, which is surmounted by a flue for carrying off the sulphur dioxide.

J. Mehrtens* gives the following results for the elimination of sulphur by this process:—

Before adding briquettes: 0.099, 0.074, 0.107, 0.090 per cent.

After adding briquettes: 0.045, 0.053, 0.066, 0.065 per cent.

Thus the mean reduction of sulphur is 35 to 50 per cent.

Where cupolas are not provided with mixers, the elimination of sulphur is carried out in a specially-constructed tapping spout having an overflow arrangement for the rapid separation of the slag. This process is adopted in America, but exceptional results cannot be expected, since the metal comes into contact for only a very short time with the desulphurising medium.

Attention should be paid to the fact that one of the qualities of Walter's desulphurising process is that the intensive activity of the reactions reducing Fe and MnO and decreasing the chemical losses reduces favourable conditions for the elimination of the dissolved gases by making the metal boil. This gives a superior casting metal possessing high mechanical properties.

* Stahl und Eisen, 1922, page 506.

* Stahl und Eisen, 1925, page 449.

British Overseas Trade in Iron and Steel.

The accounts relating to the trade of the United Kingdom in May of this year were published by the Board of Trade last Thursday. A summary of the returns is given below.

Imports.

Imports of iron and steel and manufactures thereof into the United Kingdom during May totalled 257,256 tons, of an aggregate value of £2,319,602. These figures compare with 236,852 tons and £2,018,722 in May, 1928. The imports of some of the principal products during May were as under, the figures for the corresponding month of last year being given in brackets for comparison purposes:—

Pig-iron.—Forge and foundry, 1,760 tons (3,643 tons); basic, 3,198 tons (4,104 tons); ferro-alloys, 2,153 tons (2,302 tons).

Semi-products.—Steel ingots, 5,789 tons (5,137 tons); iron blooms, 10 tons (280 tons); steel blooms, 55,880 tons (45,989 tons); sheet and tinplate bars, 35,565 tons (44,184 tons); wire rods, 13,509 tons (10,297 tons).

Finished Products.—Iron bars, 17,442 tons (14,845 tons); bright steel bars, 708 tons (1,508 tons); other steel bars, 31,746 tons (23,614 tons); special steel, 219 tons (199 tons); iron castings, 114 tons (174 tons); steel castings, 1,274 tons (1,048 tons); iron forgings, 341 tons (262 tons); steel forgings, 366 tons (1,356 tons); girders, 9,417 tons (11,732 tons); hoops and strips, 17,754 tons (15,549 tons); plates and sheets, 19,311 tons (16,158 tons); cast-iron pipes and fittings, 3,910 tons (3,765 tons); wrought-iron tubes and fittings, 8,915 tons, (6,860 tons); railway rails, 1,092 tons (1,196 tons); wire, 7,134 tons (5,551 tons); wire nails, 6,474 tons (5,799 tons); unenumerated, 8,350 tons (6,192 tons).

Imports of iron ore totalled 489,481 tons (378,611 tons); and scrap, 3,320 tons (3,023 tons).

Exports.

During May this country exported 442,774 tons of iron and steel, exclusive of scrap, compared with 359,017 tons in the corresponding month last year. In value, these exports totalled £6,715,254 and £5,632,345, respectively. Some of the principal items of export in May (and in the corresponding month of 1928) are appended:—

Pig-iron.—Forge and foundry, 26,067 tons (22,085 tons); acid, 28,793 tons (18,445 tons); basic, 3,680 tons (nil); ferro-alloys, 9,601 tons (4,554 tons).

Semi-products.—Ingots, 112 tons (113 tons); blooms, billets, etc., 1,160 tons (517 tons); sheet bars, 236 tons (62 tons).

Finished Products.—Iron bars, 3,293 tons (2,140 tons); steel bars, 29,510 tons (23,883 tons); special steel, 424 tons (307 tons); girders, etc., 6,119 tons (5,999 tons); hoops and strips, 4,867 tons (3,376 tons); plates not under ¼ in., 19,858 tons (12,242 tons); black sheets, 27,329 tons (32,715 tons); black plates, 3,394 tons (2,474 tons); galvanised sheets, 71,723 tons (61,061 tons); tinplates, 57,684 tons (47,358); cast-iron pipes, 12,330 tons (12,097 tons); tubes, 33,173 tons (24,923 tons); tram rails, 120 tons (1,072 tons); railway rails, 32,222 tons (21,134 tons); sleepers and fishplates, 5,537 tons (6,320 tons); tyres and axles, 1,789 tons (1,719 tons); wire, 8,209 tons (6,844 tons); wire manufactures, 4,569 tons (3,817 tons); nails, 1,919 tons (1,153 tons); screws, 361 tons (227 tons); bolts and nuts, 3,126 tons (2,141 tons); stoves and grates, 2,166 tons (1,367 tons); anchors, 1,686 tons (1,415 tons); bedsteads, 1,105 tons (1,067 tons); unenumerated, 29,882 tons (23,192 tons); scrap, 62,860 tons (36,975 tons).

Bull's Eyes.

This is not a new feature, because after a little private dinner at the Café Royal very late on Saturday night (or was it Sunday morning?) we noticed several prominent foundrymen appeared to us to have permanently adopted them.

* * *

On Saturday afternoon one stand at the Exhibition put a curtain round their exhibits, surmounted by a notice—"Sold Out." A competitor in the vicinity promptly altered this to read "Sold Up."

* * *

The Americans have christened a prominent member of a well-known firm of foundry facings manufacturers Plumbago Jim, as they liked his demonstrations.

* * *

We hope that Mr. Sam Johnston, the popular president of the A.F.A., will arrive back in America still "fresh."

* * *

It was very charming of the American delegation to present Mrs. Lambert with a shawl as a souvenir of her efforts to make the visit of the ladies as interesting as possible.

* * *

There was scarcely a piece of machinery in the foundry exhibition proper that remained unsold. Never has there been held a more successful show.

* * *

Glasgow in 1932 is being tipped as the city and time for the next exhibition, but isn't it a bit premature!

* * *

The Club Lancastria held one of its periodical dinners at the Cecil Hotel during the run of the Congress. We warn anybody who is favoured with an invitation in the future that they have to say a few words. One of the most pleasing features of the Congress was the number of these private functions at which opportunity was taken of welcoming in a more intimate manner groups of friends from overseas.

* * *

Some members of the Institute would like to be party to the secret held by the Newcastle Section, how to persuade their ladies that Conventions are solely for men.

* * *

For France horse cabs may be *de rigeur*, but we can assure foundrymen that in London it simply isn't done.

* * *

The idea of specialised sessions is worth extending, but accommodation presents difficulties.

"SHARP SHOOTER."

International Foundry Congress.

GUILDHALL CEREMONY, BANQUET AND OVERSEAS LUNCHEON.

The Guildhall Ceremony.

The Congress opened on Tuesday morning, June 11, in the Grand Council Chamber of the Guildhall of the City of London, when the members and delegates were welcomed by the Right Hon. the Lord Mayor (Sir Kynaston Studd, O.B.E.).

The Lord Mayor entered the Council Chamber and was preceded by the sword and mace bearers, who placed their emblems of authority upon the table as the Lord Mayor took his seat.

The PRESIDENT (Mr. Wesley Lambert, A.K.C., F.C.S.), said:—My Lord Mayor, ladies and gentlemen: As President of the Institute of British Foundrymen I have the honour to open the proceedings of the third triennial congress of foundrymen, and to ask the Right Honourable the Lord Mayor to address to us a welcome.

The LORD MAYOR:—Mr. President, ladies and gentlemen: It gives me much pleasure to meet you here to-day and to offer you a cordial welcome to the City of London in this historic Chamber. This, I understand, is the third occasion on which the foundrymen of the world have been brought together to study the scientific problems bearing on their complex industry, which is the basis of every manufacturing activity.

The first was held in Paris in 1922, and the second in Detroit in 1926; whilst at the present time Britain has the honour of staging what we hope and expect will gather together under one roof the leaders of thought in your industry from all parts of the world. Concurrently with the Congress there is being held an exhibition of foundry plant at the Agricultural Hall. I would specially draw your attention to the fact that the Government Departments, the great national research laboratories and the modern Universities have combined to stage an important exhibit showing the application of research to the foundry industry.

Before this Congress the American delegation has participated in a pre-Convention tour, during which the members have had the opportunity of visiting our great industrial centres and some of the recognised beauty spots of Great Britain. It will have been demonstrated during that tour how British conditions vary from American and Continental, as industries in this country have to cater for complex requirements coming from all quarters of the world, rather than the meeting of a standardised demand emanating from the world's largest domestic market. It is hoped that this Congress will be a profitable and pleasurable one to all overseas delegates and guests.

I end, as I began, by expressing the great pleasure that it gives me to meet you here, and to wish you every success in your undertaking.

Vote of Thanks to the Lord Mayor.

The PRESIDENT: I rise with very great pleasure to propose a very hearty vote of thanks to the Lord Mayor for his address of welcome. It is indeed an honour of which I am sure we are all conscious to have with us this morning the Lord Mayor of this great city. (Hear, hear.) The foundry industry in London, perhaps, has not the call upon the good offices of the Lord Mayor as has the foundry industry in some of the provincial cities upon the good offices of the chief citizens of those cities. Nevertheless, we regard the presence of the Lord Mayor of London as a very great honour, and I formally move a hearty vote of thanks to him.

MR. S. H. RUSSELL (immediate Past-President): On behalf of the members of the Institute of British Foundrymen and the delegates from overseas, I have pleasure in seconding this vote of thanks to you, my Lord Mayor, firstly for having opened this international Congress, and secondly for having placed at our disposal this beautiful and historic building. It is to us Britons a great honour to be able to welcome our foreign friends and visitors to this beautiful building, and we are much indebted to the Lord Mayor and the Corporation of London for the facilities they have placed at our disposal. We represent what might be called the basic side of a basic industry; we supply the raw materials for the engineering industry, and without our work that industry could not exist. We are very proud of the craft, and the craftsmanship which is still displayed in our trade, and we very much appreciate the honour you have done us in opening our proceedings.

The vote of thanks was accorded with acclamation.

The LORD MAYOR, responding, said: I have welcomed you, and you have thanked me for having done what I have been delighted to do, so that we are mutually pleased with one another. I take this opportunity again to say that I wish you every success in your work.

Presentation of Gold Medal to Professor T. Turner.

The LORD MAYOR: I am asked to present a medal to Professor Thomas Turner, who for many years was Professor of Metallurgy in the University of Birmingham. On his retirement, two years ago, a presentation was made to him on behalf of the Institute of British Foundrymen and the British Cast Iron Research Association. This gold medal I am presenting to him as a permanent souvenir of the presentation, and I feel honoured in presenting it to him.

The medal was presented amid prolonged applause.

PROFESSOR T. TURNER: I desire to thank you, My Lord Mayor, for your kindness in presenting this medal, and to express my gratitude to all my old friends in the foundry industry who have in this way signified their approval of work that I have been able to do. It does not fall to the lot of many people to look back over 45 years or so, and, after a useful and happy life, to find that their work has been so recognised, and I thank you for that recognition.

May I also take this opportunity of thanking my American friends for their goodness in presenting to me, through my son, at Detroit nearly three years ago their Siemens Medal, and for having provided me with a replica, which I received during the last few days, and which I can keep upon my desk. I have many friends in the foundry industry in America. Many of you will remember Mr. W. J. Keep, with whom I had the very closest association, and who was so eminent in your country in connection with researches in cast iron. It is a great pleasure to meet the American delegates here to-day; I am proud that for more than 25 years I have been an honorary member, and for many years the only foreign member, of their great Institution.

Presentation of the Oliver Stubbs Medal to the President.

The LORD MAYOR: I have now to make another presentation, which I am sure will give you all much pleasure. The Oliver Stubbs Medal is awarded annually to the member of the Institute who has contributed the most meritorious services during the year, and for the year 1928-29 it is awarded to your President, Mr. Wesley Lambert. As you know, he is a distinguished specialist in non-ferrous metallurgy, and by his work in the Institute he has contributed materially to the advancement of non-ferrous foundry practice. I have much pleasure in presenting this medal to you, Mr. President; may you live long to derive pleasure from it.

The medal was presented amid applause.

The PRESIDENT: I should like to thank the Lord Mayor for having presented this medal to me. At the annual meeting yesterday I knew of the award, and returned thanks on that occasion; I can only renew those thanks now, and again express my thanks to the Lord Mayor for having so kindly and so graciously presented the medal to me.

(At this stage the Lord Mayor withdrew, and on reaching the doorway of the Council Chamber he turned to give the gathering a parting salute.)

Greetings from Overseas Delegates.

The accredited delegates from other countries then addressed the Congress, and conveyed the greetings of foundrymen in their respective countries.

The United States and Canada.

MR. S. T. JOHNSTON (President, American Foundrymen's Association) said that the delegates from the United States of America and from Canada were happy to be present at the Congress, and were also very pleased to see their good friend, Mr. Wesley Lambert, installed as President of the Institute of British Foundrymen. He had been wonderfully gracious, kind and helpful to them during the last two weeks, which they had spent in this country, and they would never forget that. Mr. Johnston conveyed the greetings of the American Foundrymen's Association, on whose behalf he wishes success to the Congress and hoped that it would have a lasting impression upon the foundry industry.

Germany.

DR. SIEGFRIED G. WERNER (President, German Foundry Owners' Association) conveyed the greetings of German foundrymen, and their earnest hope that the Congress and exhibition would be very successful and of great international value. He felt sure that those who attended would leave London with the feeling that they had attended one of the biggest and finest conventions ever held.

France.

M. E. V. RONCERAY (Vice-President, French Foundry Association) said that the French delegation visited London on this occasion with very great pleasure, just as they had received with very great pleasure the foundrymen from many countries on the occasion of the first international exhibition and congress, which was held in Paris in 1922. He wished the present Congress and exhibition every success, as it deserved, and success to the foundry industry.

Belgium.

M. MARCEL REMY (President, Belgian Foundry Association), who addressed the gathering in the French language, expressed the pleasure of the Belgian delegation in being able to attend the Congress and exhibition, and conveyed their greetings.

Italy.

SIGNOR CARLO VANZETTI (Italy) evoked laughter when he apologised for being unable to speak English as well as he would like to, then offered to speak in either French or Italian, and finally decided to use the French language. He expressed the friendly sentiments of Italian foundrymen, and the pleasure it afforded them to attend, and wished the Congress and exhibition, and the industry, the greatest success.

Holland.

MR. STOEFFEL, on behalf of the Dutch Foundry Association, to which he referred as being the smallest association represented at the Congress, expressed gratitude for the reception accorded

the delegates. The foundry industry in Holland, he said, was "not so bad," but was small in comparison with the industry in Great Britain. The delegates from Holland would no doubt learn a good deal as the result of their visit, and he expressed thanks in advance for the information and help they would receive.

Poland.

M. Busac was the leader of the Polish delegation, and on his behalf M. A. Poklewski-Koziell (Commercial and Financial Counsellor to the Polish Legation) returned thanks. It was a great privilege, he said, to tender to the Congress the best wishes of the Polish Iron Founders' Association and the Polish metal industries. This was the first occasion on which the Polish foundrymen had had the privilege of participating in this great work, and they appreciated the value of being able to come to this country, whose work was held in such esteem all over the world, and had taught so much that was useful. They had come to learn and to endeavour with the greatest goodwill to create that feeling of co-operation and mutual understanding which was indispensable to the success of this great work. They wished the Congress every success.

Spain.

Senor Mas Baga, of the Spanish delegates, speaking in French, also expressed thanks and good wishes.

Luxemburg.

M. Brasseur, on behalf of the delegates from Luxemburg, expressed their thanks for the welcome extended to them, and wished the Congress success.

Czecho-Slovakia.

M. Bacher, speaking in his native tongue, returned thanks on behalf of the Czecho-Slovakian delegation.

Denmark.

M. Hess (Denmark) said he did not attend as a delegate of the Danish foundry industry—which he regretted was very small—but was present as a foundryman and business man on his own behalf. Nevertheless, he was indebted for the opportunity of saying that the Danish foundry industry was grateful to England, from which country it had learned much. He hoped the Congress and exhibition would result in the forging of still another link between the two countries, and that Denmark would receive help in the future from England as it had in the past. The English standard had always been the standard at which the Danish foundrymen had aimed.

PRESIDENTIAL ADDRESS.

Mr. S. H. Russell (Past-President) called upon Mr. Lambert to deliver his Presidential Address. Incidentally, in a reference to the award of the Oliver Stubbs Medal for 1928-29 to Mr. Lambert, he said he had been asked by the Awards Committee of the Institute to state that they considered the selection of Mr. Lambert as the recipient to be a very happy one, in that this was the first time the medal had been awarded to a representative of the non-ferrous section of the industry. Also he emphasised that the Awards Committee were not in any way influenced by the fact that Mr. Lambert was shortly to undertake the duties of President, and that the award was made entirely on merits.

The President then delivered his address:—

Mr. Russell, Ladies and Gentlemen: Recognising as I do that this is a red-letter day in the history of the foundry industry as a whole, and even more particularly so in the comparatively short history of the Institute of British Foundrymen, the prospect of having to frame a Presidential Address for this occasion was somewhat over-aweing. Not only is this occasion memorable as being the most important International Foundry Congress ever held in Great Britain, but there is also the fact that the Congress is being held in the Capital City of the British Empire, and one is conscious, therefore, that a Presidential Address of a high standard is expected—a standard which, with such very limited literary ability as I possess, cannot possibly be attained by me. I must, therefore, ask your kind indulgence in listening to the few notes which I have woven together as a Presidential Address.

The progress in the foundry industry during the last two or three decades is of such an outstanding character that to attempt to condense a description of even but a few of its principal features into the compass generally associated with a Presidential Address is to attempt the almost impossible. Full justice to a description of the wonderful progress apparent to the student of the foundry industry could scarcely be written up adequately even in tomes of encyclopædic bulk.

First and foremost place in this great progressive march is given, perhaps rightly, to the work of building design and construction, covering the buildings which comprise the modern foundry; readily accessible, substantially built, spacious, centrally heated, well-lighted and ventilated shops with approved sanitary offices, the buildings including, in many instances, both chemical- and mechanical-testing laboratories.

Gradually disappearing are many of the old-time, ill-placed, low-pitched, tumble-down, leaky, dust-begrimed, dark, ill-ventilated, insanitary sheds which in the past did duty as foundries.

The Cinderella of the engineering industry has indeed been translated from the noisesome kitchen to the spacious hall.

Importance of Transport.

Similar progress is to be seen on all sides in the various departments of the foundry in relation both to the planning of the lay-out and the nature of the plant established therein, and to the accessibility to the stock and transport yards. Quick-moving lifting machinery, including the most modern types of electrically-driven overhead travelling cranes, hoists, elevators, transporters and conveyors, operate in such manner as almost to rival the wizardry of the magician. Well-built bins of reinforced concrete for sand and stock purposes, elaborate, but highly efficient, sand-conditioning machinery, shake-out platforms, well-designed heating and drying-stoves, portable mould-drying apparatus, core-making and moulding machines for each class of repetition work, are all nowadays to be found as part of the mechanical equipment of the modern foundry. Of these several components of the foundry equipment, the progress in lifting and transporting machinery, sand-conditioning and reclaiming machinery, and moulding machines, stands out conspicuously. Much might be said of both transporting devices and sand-conditioning plant, the latter of itself comprising grinding, mixing, screening, magnetting and aerating machinery. Hydraulic- and pneumatically-operated moulding machines, large and small, roll-over, turn-over, jolt, jarr and squeeze, are now available to meet almost every requirement of repetition moulding. The introducing of machines whereby sand in ample volume is mechanically projected with the requisite speed and force not only to fill a moulding-box but also to consolidate the contents in the fashion of a mould—as exemplified by the various types of sand-slinger moulding machines found to-day in many foundries—is as truly indicative of the revolutionary progress in foundry equipment as are the well-known systems of producing castings from permanent moulds, which systems may be regarded as the present day high-water mark in foundry production in certain specialised foundries.

Revolutionising the Cleaning of Castings.

Nor have the fettling and cleaning shops been overlooked. Sand and shot-blasting plant, designed not only to be highly efficient, but having the welfare of the operator as a first consideration, power-driven saws of the circular, band and hack variety, sprue-cutting machines, flame-cutting apparatus, surface disc-grinding machines, tumbling-boxes, pneumatic anti-shock chipping hammers, emery and other wheels with hygienic dust-exhausting contrivances, and pickling baths, all are to be found in this section of the modern foundry.

Turning to the melting side, one finds, maybe, almost cheek by jowl with a modernised form—complete with charger, spark arrester and receiver—of that old and revered servant, the cupola, both converters and big-capacity gas or oiled-fired open-hearth, reverberatory furnaces, constructed in conformity with the latest and best determined principles of furnace construction; these giant furnaces giving the impression that they are parents safeguarding the battery of gas- or oil-fired tilting furnaces which do duty in supplying smaller melts of metal. The electric-melting furnace is no longer a novelty, but has already effected its introduction into the general foundry, and with the still further cheapening of electric power its debut will doubtless soon become only a memory. The wizardry which converted a pumpkin into a fairy coach for Cinderella is indeed but little removed from the magic of the foundry equipment engineer of to-day.

As regards the progress made in the moulder's art, it is obvious to anyone who has had the opportunity of studying this side of the foundry that only one conclusion can be arrived at, namely, that the journeyman moulder has lost nothing of the old-time art, but has indeed so progressed in that art that he is to-day making high-duty complicated castings, with intricate-cored parts, which the old-time craftsman would have considered to be almost outside the bounds of possibility.

Metamorphosis of Metal Utilisation.

Of the progress within the last twenty or thirty years in respect to metals and alloys for foundry use, first place must undoubtedly be given to the aluminium-casting alloys. The wonderful development of the aluminium-casting industry is so stupendous as to seem almost incredible. When one is reminded that only as recently as the year 1889 a cast block of aluminium was regarded as an object of such novel interest as to be considered worthy of inclusion as a special exhibit at the Paris Exposition of that year, whereas to-day the output of aluminium castings from a single foundry runs into many hundreds of tons per annum, one can perhaps pardon the use of the word "stupendous" when speaking of the rapid development of this branch of the foundry industry. Who, a few years ago, could have imagined omnibus wheels, pistons for big Diesel-engines, crank-cases for giant aeroplane-engines, huge pressure-vats and such like high-duty parts being specified as castings of light aluminium alloys!

In these applications it is safe to affirm that in the not very far distant future even lighter alloys, mainly composed of magnesium, will become a serious rival for the engineer's favours. Already by the use of these light alloys a saving in weight of 80 per cent. has been effected in the construction of certain parts without any diminution in strength or stability.

Special alloy-steels, high-duty irons, non-magnetic ferrous alloys, high-tenacity cupreous alloys, acid-resisting irons and bronzes, and high-temperature resistant metals are only some of the bright new stars to be found in a brilliant firmament reflecting the progress on the metallurgical side of the foundry industry. Cast-irons, with properties heretofore rarely specified, are being fabricated daily. Alloy steels of such distinctive character as would have been regarded a few years ago as day-dream ideals, are to-day specified without provoking comment. Malleable-iron castings of super-excellent quality are fabricated on a routine basis. High-duty cast

bronzes of 35 to 45 tons tensile strength are nowadays represented by single castings weighing upwards of 30 tons apiece. The chemical and superheat-plant engineers bear enthusiastic testimony to the splendid progress which has been attained in the fabrication of special irons and non-ferrous alloys to meet their particular requirements.

Centrifugal castings, permanent mould castings, large and small—both gravity and pressure die-cast—are to-day finding a ready market and are in increasing demand. Use has already been made of the word "wizardry," but, at the risk of being accused of repetition, this word alone surely best describes one's impression of the output of a modern centrifugal pipe-casting plant.

Progress in Refractory Materials.

With regard to refractories, one must be pardoned for an all too brief reference to the excellence of such material as is now available for foundry purposes, an excellence resulting largely from the unstinted, unostentatious research work instituted by the manufacturers of such material. The furnace brick of all shapes and sizes, the graphite pot, the refractory earths, the mould facings, etc., each and all show their measure of progressive excellence.

The extended use of oil-sand cores has rendered possible the mass production of intricately-cored castings, which at one time would have taxed the skill of even the most painstaking craftsman. The extended application of oil-sand cores is certainly one of the most outstanding applications contributing to the great progress in the foundry output.

Scientific Aids.

The laboratory side of the modern foundry industry must not be overlooked. The introduction of specially-constructed apparatus and the employment of standardised reagents has assisted the speeding-up of chemical analysis, and has tended towards more accurate and concordant results between one laboratory and another. Optical instruments for the examination of metals and foundry commodities are in constant use, and even the X-rays have been harnessed for the examination of castings, including those of considerable thickness of section. Pyrometers are now employed generally, and their use is recognised as essential in the non-ferrous foundry; temperature control must be credited with much of the improvement in the uniform quality of the foundry product.

Truly the realities of the modern foundry are more astounding than the phantoms of the most imaginative of the old-time foundry workers, but what is more to the point is that every improvement in the foundry buildings and equipment has a tendency to uplift the workers who are perforce benefited by the improved conditions under which they are working. In this connection there are other progressive features, although non-technical, of which mention should be made, and which have for their object the welfare of the employees and the cultivation of that social well-being and intercourse so desirable between master and man.

"Welfare" in the Industry.

Well-lighted, centrally-heated canteens for the workpeople, at which wholesome food can be obtained at nominal prices and in which an air of good-fellowship exists, are to be found attached to the more up-to-date factories, and in some instances spacious reading-rooms, well supplied with technical and other literature, are available for the use of employees.

First-aid and ambulance stations are to be found attached to many works, and competent certified attendants are available to cleanse and dress minor injuries, to deal with "gassed" or "shock" cases, and to render first-aid in the case of more serious accidents in the workshops. Sports clubs have also been instituted, many works possessing their own sports grounds for cricket, football, tennis, bowls, etc., and in addition inter-departmental clubs have been formed for swimming, rowing, cycling, running, country rambles, and other outdoor sports. Indoor sports for the winter evenings are also catered for, billiards, skittles, boxing and card-playing being favourite pastimes. There can be no question whatever that the technical progress and the better social conditions prevailing in each section of industry must tend towards beneficial development for the good of the community, and serve to encourage that delight in the task of the individual without which no material progress worthy of the name can be assured.

Who can foresee the immense possibilities of the future of the foundry industry? When one is reminded that so comparatively recently as the reign of Queen Elizabeth only seven or eight metals were known, of which only four, namely, iron, copper, tin and zinc, were in use for the compounding of constructional—as distinct from ornamental—alloys, whereas to-day, as a result of intensive scientific research, sixty-one metals are now available, and that, year by year, one or more of the previously rarely-used metals is being harnessed to the service of mankind in the form of alloys for industrial uses, the immense possibilities of the utilisation in the foundry of these later-discovered metals affords subject-matter for very fascinating conjecture.

It may be seen, by the use of a simple formula, that if a complete series of binary—two-metal—alloys of all the known metals were compounded in merely one uniform proportion, such as 50:50, the number of alloys resulting would be 1,830; if ternary—three-metal—alloys were made also in one definite proportion only, the number of different alloys would total 35,990. To go but one step farther, if a complete series of quartenary—four-metal—alloys, in one uniform proportion, such as 25 per cent. of each of the four metals constituting any one alloy, were attempted, 521,855 separate alloys would have to be produced before each of the known metals was thus proportionately employed in its own group in this series of alloys.

One may inquire: Whence has come the scientific knowledge and the wonderful mechanical and technical skill and the increased regard for the welfare of his fellow-men which have rendered possible the magic of this remarkable progress during the last two or three decades? One need not look much farther afield than around this International gathering of foundry experts—proprietors, managers, supervisors, equipment designers, scientifically-trained metallurgists, and researchers.

International Co-operation.

Science, art, industry and craftsmanship know no nationality. It would be invidious, therefore, to name any nation as deserving of the major share of the credit of having provided the means which have made possible the progress which has been so inadequately outlined in this Address. There are names in this connection that one would dearly like to mention; giants of their calling—names that are on the tongue of every earnest foundry worker, names of many of those present on this occasion and of their forebears, and also of silent men not so well-known maybe owing to the innate modesty of their nature, names which nevertheless equally deserve to be placed upon the roll of honour. And what a roll—British, American, French, German, Belgian, Russian, Italian, Swedish, Polish, Dutch, Spanish, Swiss, Portuguese, Czeck, Japanese—all have generously contributed their quota towards improving the condition, the efficiency, and the output of the foundry industry.

It would ill-behove me were I to neglect such an occasion as this for expressing on behalf of the British foundry industry as a whole, and more intimately on behalf of the Institution of British Foundrymen, the indebtedness which the British foundrymen owe to those nations just mentioned for the splendid efforts of the foundry workers, foundry engineers, and research metallurgists belonging to those respective countries—efforts which have so materially assisted in raising the status of the foundry industry nearer to an equality with the civil, mechanical and electrical engineering industries throughout the world.

I trust that this Address, presented by a very humble student of the industry, will at least have the effect of bringing even closer together those Institutes and organised bodies representing the foundry industry of the world, and that by mutual association and close co-operation, and the free interchange of knowledge and ideas—which interchange forms the primary object of such an International Congress as is now being held—still further progress may be attained, until the industry shall be raised to that high status that its science and craftsmanship so fully merits.

To the Members of the Institute of British Foundrymen, to whom, as President, I can speak openly, let us see that we keep the flag flying high. It is up to us, together with our confrères of the Foundry Equipment and Supply Association, to see that we continue to contribute our quota to the continued progress of the industry we have so much at heart. To those representatives of the overseas organisations I offer every good wish in their future endeavours towards the further progress of this great basic industry, and trust that they will convey to all their fellow-members the appreciation of the Institute of British Foundrymen for the great efforts of their countrymen which have so materially contributed towards the progress I have attempted to review.

A Vote of Thanks to the President.

MR. F. P. WILSON (Senior Vice-President) proposed a vote of thanks to the President for the admirable, dignified and interesting address he had delivered. In it the President had reviewed progress in the foundry trade in such a way as to interest all present, whether they were scientists, practical foundry workers, suppliers of foundry requisites, or connected in any way with the industry. He hoped that, if there were delegates present who were unable to understand the English language sufficiently closely to be able to follow every word, they would be able to have it translated in order that they might reap full advantage from it.

MR. V. C. FAULKNER (Past-President), who seconded, said that this was the third Presidential Address that Mr. Lambert had prepared, but the one he had delivered was undoubtedly the best he could produce, and the best the Institute could produce. It was a great privilege and honour to be able to second the expression of sincere appreciation for his description of what the modern foundry industry is and what it would be.

The vote of thanks was carried with acclamation.

The PRESIDENT responded. Commenting on Mr. Faulkner's remarks, he said it was quite true that he had written two addresses before writing the one he had delivered. The reason was that, after careful consideration, he had come to the conclusion that, inasmuch as this Congress was of an international character, it behoved him to write of something that would interest all present rather than to discuss any domestic or internal matters which might concern, perhaps, only the British foundrymen. It was for that reason he had decided to review foundry progress as he had seen it during the last three or four decades.

The Junior Vice-President.

It was announced by the President that Mr. A. Harley, of Coventry, had been elected Junior Vice-President of the Institute.

MR. HARLEY expressed his deep appreciation of his election. He had never appreciated fully before, he said, how impressive such a Congress as this could be. When so many delegates from overseas had responded to the invitation to

address the Congress he had felt that such Congresses must play a very great part in maintaining the brotherhood of nations, which was so much desired.

Test Bar Committee's Report.

Mr. John Shaw presented a report of the work of the Test Bar Committee of the Institute for the past year.

(The discussion on the Report was deferred until a later stage of the proceedings.)

Banquet.

The annual banquet of the Institute of British Foundrymen was held at the Hotel Cecil, London, on Wednesday, June 12, Mr. Wesley Lambert presiding over a company of some 450 members of the Institute, overseas delegates and ladies.

Research of International Bond.

After the loyal toasts had duly been honoured,

Sir John Dewrance, G.B.E., proposed "The Institute of British Foundrymen and its President," and said that having regard to the very successful international conference that had been organised by the Institute, everybody present would be delighted in joining in in this toast. He himself was a practical founder. When he left college he went first into the foundry, where he studied with great care and eventually became sufficiently skilled to produce a casting which was exhibited in the Royal Academy. He believed the artist had an idea that it was his effort in connection with the casting that influenced the Committee more than the work that he (Sir John) had done, but he thought he himself could say that if the casting had been faulty it would have been remarked upon. (Laughter.) That was in 1880, and since that time he had started a research department in his own firm, which he believed was the first ever established by an engineering firm in Great Britain. As the years had gone on it was common knowledge that research had grown gradually and steadily. He hardly cared to speak of science in the presence of so many eminent scientists, but he would like to say that during his long experience it had gradually been manifested that science has had a great influence and that it would ultimately unite the great civilisations of the world. (Applause.) The great institutions which organised international congresses, such as the International Foundry Congress, were doing that which was of the greatest possible assistance to the civilisation of the world, and he was delighted to be present at a gathering of so many representatives of overseas countries who had come long distances to attend this Congress. He hoped they had enjoyed themselves and that they would go back to their own countries feeling they had received a hearty welcome in Great Britain; certainly Great Britain would be delighted that they should have that feeling. There had sometimes been an impression that Great Britain in the past had been greedy of the surface of the earth, but the real desire of Great Britain had always been to civilise the world, and all those other countries which assisted were doing the same good work as the Britishers. (Loud applause.) It had always been the greatest pleasure of the Britishers to welcome their international friends and so to encourage the general harmony of the whole world. He was convinced that the International Foundry Conference had assisted to that end, and we in this country looked forward to the occasion when the overseas visitors would again be welcomed in this country. He coupled with the toast the name of the President of the Institute of British Foundrymen, Mr. Wesley Lambert.

Banquet in the Grand Hall of the Hotel Cecil.

The President, replying to the toast, said he had a pleasing and easy task, inasmuch as the few words he had to say were of the nature of a thanksgiving address, and moreover, in the words of a popular song, "I Know I am in Jolly Good Company," and that he was also fortunate in being well looked after. The toast master had given him the lead as to how to commence; a certain lady had promised to signal to him if he kept on for too long; one silent member who he noticed had seated himself at the far side of the hall was going to rise from his seat if he did not make himself heard; and an American friend with whom he had kept close comradeship during the past fortnight was going to put his hand up should he so far forget himself as to speak with an American accent.

Growth of Bell Founding.

On behalf of the Institute of British Foundrymen, he thanked Sir John for proposing the toast of "The Institute" and for the very kind things he had said, and to thank them all for the hearty manner in which the toast had been accepted. They were deeply grateful to Sir John for his continued interest in the Institute in particular and in the foundry industry in general. It was most encouraging and gratifying when a gentleman who had attained the position in science and industry that Sir John had attained to find him associating himself with the Reception Committee for the present International Convention of Foundrymen. On the last occasion of a banquet in London connected with one of the annual conferences, Lord Melchett honoured them with his presence as the principal guest. In his speech on that occasion there were two things among others that Lord Melchett said which he personally noted, and to which he should like to make brief reference. Lord Melchett said that he was glad that the Institute of British Foundrymen appreciated the importance of close contact internationally. Were Lord Melchett able to be with them that evening he would have gathered that they were still continuing the policy of close contact internationally. The other thing to which Lord Melchett referred was the founding of bells. Lord Melchett wondered whether, with all the aid of modern science, we were nowadays able to equal the bell mixtures of some of the old bell founders. It might interest all of them to know that since the Great War one bell foundry alone—and that within ten or twelve miles of Lord Melchett's London office and which foundry he personally visited—had produced no less than 2,640 church and tower bells, varying in finished weight from 18¼ tons to a few pounds each; the total weight of bells approximating 1,000 tons. Of these bells quite a considerable proportion were cast for overseas customers, and experts of all countries concerned were agreed that for sweetness and perfection of tone, and as examples of the bell founders' art, these bells had never been equalled in the history of bell founding.

He was proud to occupy the chair that evening, proud not only personally, but because the fact of his occupying the chair as President of the Institute of British Foundrymen exemplified the democratic constitution of the Institute. The presidential chair of the Institute of British Foundrymen was not a perquisite of the foundry proprietor, but was open to anyone who like himself was only an employee. He was proud because he honestly regarded the Institute as being one of the most important, if not the most important, technical Institution in Great Britain. He was proud also because the

Institute was flourishing and was progressing along the right lines, and that this was recognised was, he thought, apparent to all who look around at the gathering, including as it did so many distinguished people of this country and from overseas.

He did not propose to bore anyone with a recital of the history and the aims and objects of the Institute, neither did he propose to analyse the membership figures, nor to give the titles of the technical papers read before the various branches or submitted at the present Convention, but it would ill behove him were he not to take this public opportunity of thanking all those gentlemen who had presented papers. Incidentally, nearly 150 technical papers had been submitted during the past session, and as a member of the Literary Committee he could bear testimony to the value of those papers. Also a word of praise must be given to the Cast Iron Test-Bar Committee, which had done such good work during the last two years, and to the Educational Committee for the good work which was being done in reference to the better training of foundry workers of the younger generation.

It would be unfair of him to poach his colleagues preserve, but as one of the Reception Committee he must express delight at the presence of so many overseas delegates and of the ladies at the banquet. They hoped that the foreign delegates would not leave this country without having recognised that the foundry industry in Great Britain was much more alive than perhaps they were led to think, and that the ladies would bear testimony that London was not always fog-bound.

Acknowledgment of Help.

Before concluding, the President said he had a further pleasing duty, namely, to acknowledge the services of all those ladies and gentlemen who had so generously given their best services on the various Committees associated with the organisation of the present international Conference. A great deal of work was involved, and all had worked right loyally. Then he wished to renew the expression of thanks to the Lord Mayor for his kindness in loaning for the use of the Institute the City Council Chamber and the other departments of the Guildhall, and for his welcome, and to the President of the Institution of Mechanical Engineers for like kindnesses. To Sir John Dewrance and to Sir Hugo Hurst; to Messrs. Bridges, senior and junior—organisers of the Foundry Exhibition at the Royal Agricultural Hall—and to the Conference Committee of the Foundry Trade Equipment and Supply Association for their kindness and generosity in acting as hosts at several of the London functions, and to all the patrons who had assisted financially. To Dr. Rosenhain, F.R.S., and Mr. J. G. Pearce, M.Sc., who had been mainly instrumental in getting together the technical and educational exhibits at the Exhibition at the Royal Agricultural Hall. To the officers of all the various branches for their splendid and successful efforts in entertaining the overseas delegates, and ladies who were able to take the pre-convention tour through Great Britain. To the Lord Mayor, Mayors, Sheriffs, Presidents of the Chambers of Commerce, and other gentlemen and their ladies for the kind receptions given and the hospitality accorded, and the Master Cutler and Mistress Cutler for like favours. To all those proprietors, directors and managers of works, factories and foundries throughout the kingdom for kindly throwing open their establishments for works visits both for gentlemen and ladies and for their generous hospitality on those occasions, and to those members of the staff at the respective works for their kindness in acting as guides and instructors.

He desired to mention one more name, which he was sure would be received with acclamation—Mr. H. G. Sommerfield—the Hon. Secretary of the London Convention Committee. He remembered having read that people entering a church had sometimes mistaken the acolyte for the high-priest. Mr. Sommerfield is indeed the high-priest and he was but the acolyte. Mr. Sommerfield had done yeoman work, and to his efforts, coupled with those of Mr. Makemson, the General Secretary, the success of the function and of the Convention as a whole were mainly due.

On behalf of the Council and members of the Institute of British Foundrymen he thanked Sir John Dewrance for his kindness in proposing the toast of the "Institute of British Foundrymen," and all present for the hearty manner in which they had accepted it, and he thanked them personally for the forbearance with which they had listened to his response.

United States of Europe.

MR. S. H. RUSSELL (Past-President, Institution of British Foundrymen), proposing "Our Guests," extended a hearty welcome to them all, and especially those who had travelled many thousands of miles to attend the Congress and visit the Exhibition. Speaking specially to the American delegates, he suggested that during the tour of our industrial centres and also the visits that had been paid to some of the historic spots in this country, they might have been impressed with the fact that this country is not so vast as their own, where there were 42 States, each without a tariff wall between them, and all working under one Government. On the other hand, in Europe there were 28 nations, nearly everyone speaking a different language, each being a sovereign nation, and all having a high tariff wall between them. He believed that, excluding Russia, the area of Europe was very much smaller than the area of the United States, but the prophets foretold that the substitution of one control for the independent sovereign control of the various European nations was entirely within the range of human possibility. At the same time the difficulties were enormous. There was in the first place the difficulty of language, and there was, of course, the intense national spirit that had grown up inside the various nations. However, the prophets told us that the writing was on the wall, and that there is a movement towards grouping the world in a relatively few units instead of into a large number of individual nations. This Conference afforded also the opportunity of giving expression to the belief in this country in the principle of the free exchange and interchange of knowledge in the foundry craft. The old days of secrecy and secret methods had almost entirely disappeared, and he knew that those sentiments were also held by all the overseas delegates. (Hear, hear.) The toast was coupled with the names of Mr. S. T. Johnston (President of the American Foundrymen's Association) and Sir Joseph Petavel, F.R.S. (Director of the National Physical Laboratory).

The Democratic A.F.A.

MR. S. T. JOHNSTON, who made the first reply, expressed appreciation on behalf of all the overseas delegates of the splendid hospitality they had received during their visit to this country, and speaking specially of the American Foundrymen's Association, said that organisation had 2,500 members. A man was not too old to join that body because there were some white haired men who were members, some of whom had been members for many years and others who had recently joined. Nor could a man be too young to join because there were some apprentices in the Association and many of the younger workers. Again, a man could not be too learned to join because some of the most distinguished men of science were members of the A.F.A., and, on the other side, a man need not consider himself too ignorant to join because the membership included some foundrymen who did not know much more than the rough and tumble of the foundry. Nor need anybody be too humble to join because the membership included many in the humble walks of life connected with the foundry trade, and, finally, a man need not be too proud to join the organisation because there were already on the books many men of high position, both on the technical and commercial sides, and who were giving valuable assistance in the work of the Association. After once more referring in highly appreciative terms of the good time all the delegates had had during their stay in this country, and mentioning particularly the visit to the provinces, Mr. Johnston read a printed resolution from the American Foundrymen's Association, which was passed before the American delegates left for their tour of this country, and presented it to the President of the Institute of British Foundrymen in the form of an illuminated address.

The Antiquity of the Foundry Industry.

SIR JOSEPH PETAVEL, in the course of his reply to the toast, said it had occurred to him that the foundry was not only the most fundamental art in connection with our present civilisation, but also possibly the earliest art which indicated the dawn of civilisation. As man passed from the savage to the first sign of civilisation the first development was the foundry. For the first time he began to produce metals, and for the first time his degree of cultivation of intelligence was measured by the success of his art of founding. They had all heard of the magnificent work now coming from Egypt in gold and silver dating 4,000 years ago, and it revealed a considerable knowledge at that time of metallurgy. He understood that the gold alloy was chosen because it was particularly easily worked and was malleable, and that was one reason why such beautiful work was possible in those days. With the development of civilisation the art of the foundryman became the basis of the art of the engineer. In the earlier days the mechanical engineer could not exist because he had no metals, but when metals came to the fore, when the foundryman began to produce the metals, then mechanical engineering began to transform the world. In the earlier days the foundry was the seat of mystery, and he understood that even down to comparatively recent days there still remained secret mixtures which were added to metals and which alone caused the excellence of the product. In more recent times, however, metallurgy had produced not merely the few metals which the ancients used, but literally dozens of new metals which, combined in various proportions and treated in different ways, formed the basis of the present advance of mechanical engineering. All that had changed the foundry from a place of secrets and mystery to a laboratory of science, and at the present time scientific work was as essential as practical experience. Sir John Dewrance had spoken of the manner in which he had led in the application of research to engineering, and it was the function of the National Physical Laboratory to help industry with knowledge and advice. Mr. Russell had suggested that the time for secrets had passed and that the time for the unity of the world had come. That was a thing to look forward to, but that development was very large, and it would tax even the Institute of British Foundrymen and the American Foundrymen's Association severely to find a melting pot of sufficient size to fuse the European nations together. It was to be hoped that in the future that state of things would be brought about, but for the present he was led to believe that even the American Association found that melting pot a little difficult to manage at the present time with complete success. (Loud laughter.) Finally, Sir Joseph expressed the deep appreciation of the guests, and the ladies, for a delightful evening.

A splendid musical programme was provided during the evening.

Luncheon to Overseas Delegates.

The overseas delegates to the International Foundry Congress were entertained at luncheon on Thursday, June 13, at the Agricultural Hall, London, by the President and Council of the Foundry Trades Equipment and Supplies Association, in association with the organisers, Messrs. Bridges & Sons, Limited.

Mr. Wesley Lambert (President, Institute of British Foundrymen), proposing "Our Guests," and expressing his delight in doing so, said he had visited 40 different countries from time to time; in many of them he had inspected foundries, and in every case had had a splendid reception. In some cases he had what was vulgarily known as "blown into" a foundry without any introduction, but when he explained the object of his visit he had never been turned away. He had recently been in Germany and Denmark, and had visited foundries there and had received a splendid reception, and it was for these reasons that he said he was delighted to have the opportunity of proposing this toast to the overseas guests. There were present representatives of 12 different nationalities, and it would be agreed that the Congress had been a truly international one. The United States, Germany, France, Italy, Belgium, Holland, Czecho-Slovakia, Poland, Spain, Denmark, Luxemburg and Russia had all sent delegates, not to mention representatives from some of our large overseas dominions, namely, Canada, Australia and India. The term "guest" in the English language had a special significance. It meant one who was "received and entertained." So far as the "reception" of the overseas guests was concerned they would agree that they had been "received" in this country, and those who had attended the various functions and visited the many works would, he believed, agree that they had been "entertained." He would go no farther than to say that if they had not, it had been entirely their own fault. (Laughter.) He wished also to take the opportunity of thanking the overseas delegates for so kindly conveying greetings on the occasion of the opening meeting of the Congress in the Guildhall. He regarded that as a delightful ceremony. One overseas delegate after another came forward with his own little word—short though it might have been—of greeting, and it was appreciated very much indeed by the Institute of British Foundrymen.

Speaking with regard to the International Congress, Mr. Lambert asked "What does it really stand for?" He said he was confident that the International Congress was bound to bring the nations of the world closer together. The papers and interchange of ideas would be helpful in that direction, and when he said the Congress would bring us nearer together he did not mean merely in the technical sense. He believed it would help in developing the recognition that we are all brothers, and that as brothers there would be a certain amount of of esteem and love between them, so that he felt confident that the overseas delegates would leave this country feeling that they had had a welcome which would help to knit together much more closely the friendship that had existed previously between the nations of the world. A significant feature was that Mr. Koniukhov, President of the Machinery Technical Syndicate of all Russia, was present, and there was a significance attaching to that which perhaps some of those present might not understand and which he personally could not explain. He understood, however, that Mr. Koniukhov was authorised to purchase in this country foundry material, and it was a great honour that he should have come here to see what this country could offer. The toast was associated with the names of Mr. Fred Erb (U.S.A.), Dr. Werner (Germany) and M. E. Ronceray (France).

Mr. Fred Erb (A.F.A.), responding to the toast, said that "received and entertained" was but a partial description of the hospitality the overseas delegates had received during their stay in this country, and not only on behalf of the American delegates but on behalf of all the overseas delegates he expressed their sincere appreciation. Whilst listening to the greetings of the overseas delegates at the opening of the Congress at the Guildhall it had occurred to him what an advantage it would be if there was one universal language. Speaking of the Congress, Mr. Erb said it was a long time since the international Congress was held in Detroit, and the American delegation extended a hearty welcome not only to British foundrymen but to foundrymen throughout the world again to visit America. It was felt that nine years was too long to wait before another International Congress was held in America, and the American foundrymen wished to have one sooner. Therefore on behalf of American foundrymen he extended this invitation with the assurance that it was a sincere one.

Dr. Ing. Werner (Germany) similarly expressed appreciation, not only on behalf of the German delegation, but of all the delegates at the reception they had been given in this country. The Exhibition had been for all of them a place where they had found new ideas and had seen new things, and where they had met and made many friends. There had been opportunities for the exchange of ideas and conversations with the manufacturers of plant and the suppliers of materials, and the co-operation between the foundrymen in this country and the Foundry Trades Equipment Association was clearly of the greatest benefit. In Germany they would have to work on similar lines, and he hoped it would be possible to create the same degree of co-ordination as existed in Great Britain. Every one of the delegates would go back to their own countries with memories of this visit, which would live long, and they could only assure any British foundryman that he would receive a cordial welcome at any time he should visit one of their countries and be given all the assistance he might require.

M. E. V. Ronceray (France) also spoke in similar terms on behalf of all the delegates, although speaking nominally for the French delegation, for the wonderful enthusiasm with which they had been received. It was, he said, the greatest possible pleasure for him to be again with his friends in England, and he and his colleagues would carry back to France the warmest greetings to their colleagues there, which he was sure the British foundrymen would wish him to do. He could only hope that one day the French foundrymen would be able to return the hospitality they had received at the hands of their British confrères and do something towards still further cementing that friendship which had existed between the two nations for so many years.

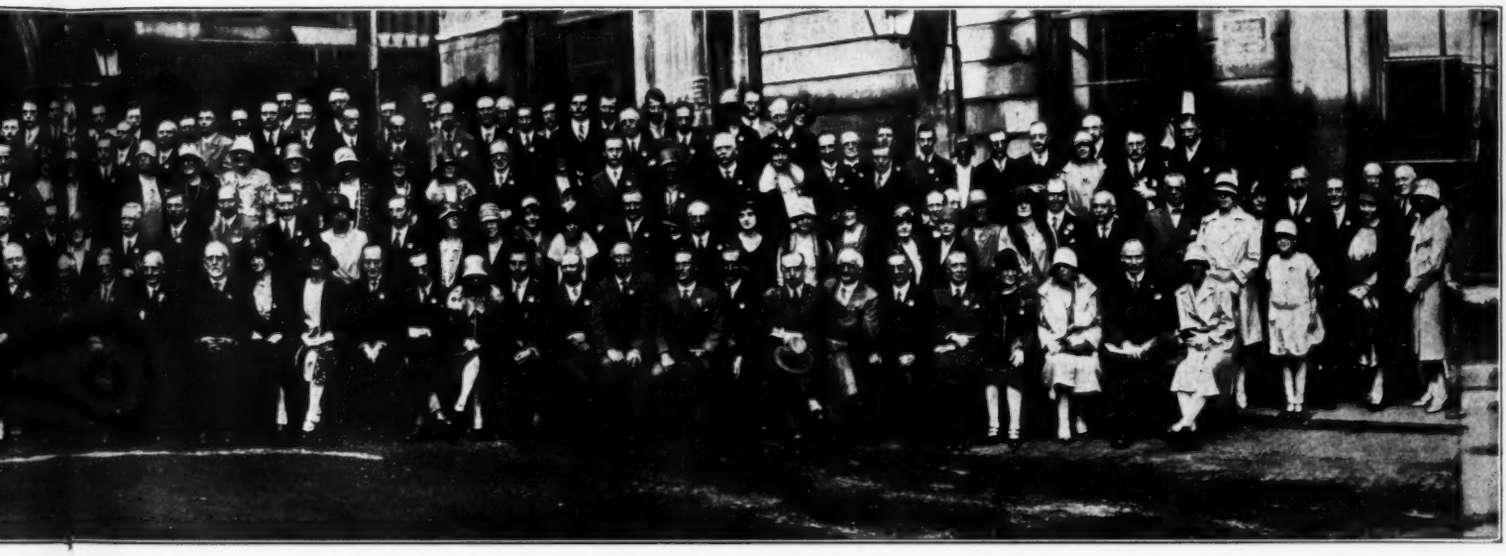
Mr. F. P. Wilson (Senior Vice-President, Institute of British Foundrymen), proposing "The Chairman," said he wished he had the ability to put into the 12 or more tongues represented at the luncheon the thanks of all of those present to Mr. Winterton and the Foundry Trades Equipment and Supplies Association for the hospitality that had been extended to them that day. The Association could feel that by such actions as this and the holding of the Exhibition it was playing a part in uniting the nations of the world. It was a great pleasure to see so many nations represented at the Exhibition and to feel that they were being drawn together more closely. The position now was that the foundry trade could not do without the Foundry Equipment and Supplies Association, and the Association could not do without the trade. They seemed a happy family now, and it was in that spirit he wished to thank the

A Group of the Participants in the 3rd Triennial International Foundrymen's Congr

Chairman and the Association for their hospitality.

MR. H. WINTERTON (President, Foundry Trades Equipment and Supplies Association), responding to the toast, said the time was when the foundry and those who supplied it were as widely opposite as the poles, but to-day both sides realised that one without the other would be very weak. So far as the Association was concerned, it had every pleasure in placing its researches and its laboratories at the disposal, not only of the other associations connected with the trade, but also, as far as possible, at the disposal of all its friends in the foundry trade, because it realised that by so doing it was forwarding the interests of everybody concerned. In this connection he specially mentioned that the Association has no connection whatever with wages or price-fixing, but exists solely for the benefit of the industry. He looked to the future generation of foundrymen to go forward with very much greater strides than had yet been the case. They were not satisfied with the present position, and sincerely hoped that in the future a very much better time was in store for the trade. Continuing, Mr. Winterton said he could not respond to the toast without at the same time acknowledging the invaluable help that the Association had received from its officials, and particularly from Mr. Kenneth Bridges (the honorary secretary) who had been responsible for the organisation and great success of the Exhibition. He believed that the present Exhibition was the best that had ever been staged in this country, if not in the whole world. Finally, Mr. Winterton said he could not sit down without referring to a point mentioned by Mr. Lambert, namely, the presence of Mr. Koniukhov from Russia. This delegate had come over here prepared to discuss with the Foundry Trades Equipment Association the possibility of establishing certain trade relations with Russia. A Committee had been formed, and last night he had been honoured with the suggestion that he should join this Committee. Whether he did so or not was in the lap of the gods, and he invited the members of the Council of the Foundry Trades Equipment Association who were present to meet him in the President's room at 3.30, when the whole matter would be gone into and a decision taken.

Mr. Winterton then welcomed the delegates to the Exhibition, and urged them to inspect it thoroughly and criticise it in every possible way, so that advantage could be taken of those criticisms in future Exhibitions.



FOUNDRYMEN'S CONGRESS, PHOTOGRAPHED IN THE PRECINCTS OF LONDON'S HISTORIC GUILDHALL.

A Note on Indian Iron Foundry Practice.

By H. LEWIN.

Iron castings of all descriptions and sizes are produced in the foundry by the usual processes known to all foundrymen. They in India also experience troubles in the foundry more or less similar to other foundry folk. The foundry buildings differ from those in England, being open on all sides from the ground level to a height of seven to ten feet, so that the foundry floor can be entered at any point. This is done to meet climatic conditions, and has its advantages and also disadvantages.

The systems of charging the cupola vary considerably at one very large works. There is a set of cupolas which have the charging bogie raised to the charging platform by means of an electric hoist, and then wheeled along the platform to the charging door. At the same works there is another set of cupolas using an inclined rail, the bogie being drawn up the incline by means of a steel wire-rope attached to an electric winch, and self tipping the charge into the cupola. At a third set of cupolas the raw materials were put into a specially-designed bogie and hoisted by an overhead electric crane, which then travelled to a position directly over the top of the cupola and lowered the loaded bogie on to two curved rails fixed on top of the cupola stack.

This caused the bogie to open and release the contents, which fell vertically into the cupola. Upon inquiry, it was ascertained that working costs of a comparative nature were not kept relating to these three methods of charging, so that no one knew which of these systems was the most economical to operate.

A further group of cupolas recently installed had the blower house arranged at a higher level than the air inlet to the cupola. One day, after the usual light-up at the cupola, perhaps a blast gate in the air line was accidently left open whilst the coke bed was burning through; whatever the reason, the blower house and all its contents went up in the air, suggesting that gases from the cupola had travelled *via* the air pipe line into the blower and the blower house, and when the man in charge had gone to start up an explosion had occurred.

In quite a number of foundries permanent receiving ladles are installed in front of the cupola, being mounted on trunnion bearings to facilitate pouring the molten metal into the distributing ladles, tending to better mixing of metal.

Handbarrows are rarely seen in the foundries, all sand being conveyed to the foundry floor or taken away in baskets carried on the heads of men or women as the case may be, but mainly women. It is a common sight to see cows roaming about the works up country, and when they feel inclined will wander into the foundry and lay down in the shade in the middle of the moulding floor. I have frequently seen them eating the côre ropes in the jobbing foundry, and being chased away by an infuriated coremaker.

The labour in the foundry, particularly those men who are ramming up, wear only a loin cloth, and it is really remarkable that one hears of so few accidents by burning. A caster is sometimes provided with a pair of heavy boots, which he will put on, perhaps a size or two too large, and not bother to lace them up. If the metal happens to splash about when pouring into moulds, the wearer stands a good chance of getting molten metal into his boots. As they always go about barefooted the soles of their feet are naturally hard, and one often sees them stepping on to hot boxparts after a mould has been cast. The appearance and conduct of this labour would give the "safety first" men at home food for thought.

British Empire Scholarships.

The Entrance Examinations for the award of British Empire Scholarships in the Faculty of Engineering, Loughborough College, have now been completed and awards made. The Scholarships are tenable at Loughborough for the full period of the Diploma Course, and the Governors of the College have approved the following Awards for 1929:—

L. M. G. F. Cabral, Queen's College, Georgetown, British Guiana, S. America; S. W. Millward, the Grammar School, Cheltenham; F. G. McDonald, the Technical High School, Johannesburg, South Africa; T. D. Walshaw, Hurstpierpoint College, Sussex; Paul Finucane, Lawrence Royal Military School, Sanawar, India; and Horace I. Price, County School, Abertillery, S. Wales.

These Scholarships are open to all British subjects resident in any part of the Empire and are of the value of £75 per annum. Applications were received from a large number of the Public and Secondary Schools in England, South Africa, Rhodesia, Australia, British Guiana, India, and the Federated Malay States.

XUM

Practical Points from the Metallurgy of Cast Bronzes.*

By H. C. Dews.

Metallurgy is not always a welcome dish to serve before foundrymen. The environment in which the foundryman has to grapple with the rugged problems of daily production does not conduce to that detached thinking which scientific theories often demand. In the foundry considerations which appear to offer no immediate prospect of facilitating or cheapening the work in hand are apt to be ruthlessly pruned away and a short-sighted policy inimicable to the well-being of the industry is apt to develop. Without an occasional pause to survey the progress of knowledge, the foundryman becomes intolerant of the work of the pure scientist who is striving to advance the boarders of knowledge and ultimately to improve practice in the foundry.

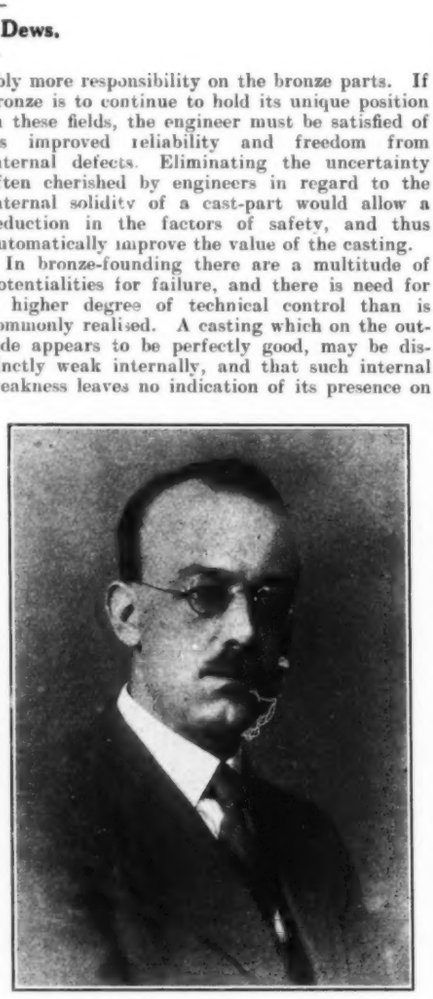
The metallurgist is not without responsibility for the unsympathetic reception which his work often receives in the foundry. The greatest disability under which most scientific workers suffer is their incapacity to present their work in language which the ordinary person can easily understand. Probably the most difficult part of any scientific research is to explain it in non-technical language. However clearly the scientist himself may see the light it appears invariably to be his lot to leave the layman floundering in a welter of words. The critical test of a scientific theory, however, can only be applied by putting it to practical use, and a scientific worker must be measured by his ability, not only to make his work applicable to practice, but to make it understood by those whose practice it is intended to modify. Before he can do this it is often necessary to convert the practical man to a scientific method of thinking, and when the practical man's interest is deepened in appreciation of scientific reasoning his ability and usefulness will be increased in no small measure.

The essence of scientific thinking—that there can be no effect without a cause—does not always appear to permeate foundry technology, or else there would be more searching for the cause of those abundant troubles now blamed on the foundry "imps." To discover the cause of a failure is to go a long way on the road to finding its remedy and, what is more, it is the straight road. To try and remedy a fault in ignorance of its cause is frequently as progressive as running round in a circle.

The production of gun-metal castings is a practical job; but more than practical knowledge is needed to carry out the job successfully. Some knowledge of the underlying theory is emphatically necessary, and the more these theoretical questions can be worked out alongside practical production the more will the practice benefit. The points which are to be discussed in this Paper the author believes to be of practical importance, and their theoretical aspects are dealt with for that reason.

It is a commonplace at the present time that engineering science is progressing faster than the improvement in materials. In many branches development is restricted by the apparent limitations of available materials, and new materials are being eagerly sought. At the same time that research into new alloys is being explored there is still a demand for improvement in the old materials. This is particularly true for bronze alloys. The choice of bronze for certain parts of steam and hydraulic machinery is inevitable, whilst at the same time the higher temperatures and pressures at which such machinery is now being driven imposes considerably more responsibility on the bronze parts. If bronze is to continue to hold its unique position in these fields, the engineer must be satisfied of its improved reliability and freedom from internal defects. Eliminating the uncertainty often cherished by engineers in regard to the internal solidity of a cast-part would allow a reduction in the factors of safety, and thus automatically improve the value of the casting.

In bronze-founding there are a multitude of potentialities for failure, and there is need for a higher degree of technical control than is commonly realised. A casting which on the outside appears to be perfectly good, may be distinctly weak internally, and that such internal weakness leaves no indication of its presence on the outside of the casting, is the bronze foundryman's chief pitfall. It is only by careful production and stringent testing that failures in service can be avoided. Furthermore, it is apparently only slight variations in technique that may introduce such grave defects. Take, for instance, the provision of test bars in Admiralty gun metal. The British Admiralty specification calls for 16 tons per sq. in. tensile strength, and this result can be readily obtained in normal foundry practice. Yet wide variations in test results are frequently reported. It is easy, as a matter of fact, to cast two test-bars out of the same ladle of metal, one of which will have a tensile strength of nearly 20 tons per sq. in., and the other only about 8 tons per sq. in., and yet both on the outside will appear to be perfectly good metal. The different strengths of the bars will be due to the fact that one will be built up of solid and continuous metal, whereas, the other will be honeycombed with spaces. In the first case the apparent section is the real section of metal carrying the load, while in the second case the load is carried actually by a real section of metal much less than the apparent section. In Fig. 1 is shown a photomicrograph of a section cut from a weak bronze. The black areas are holes in the metal, and from the extent of these holes it can be seen how little solid metal there is to carry the load. A section from the same bronze, but cast correctly, is shown in Fig. 2, and it can be seen to be perfectly good and sound.



Mr. H. C. Dews.

It is necessary to produce bronze which shall consistently be free from internal porous-places in order that the castings shall have the maximum strength of which the bronze is capable, but before such a desirable standard can be attained one must know what causes some bronzes to be porous. It can be said at once that the porosity is due to the effect of two peculiarities of the freezing. In the first place bronze freezes over a range of temperature, and, secondly, it contracts in volume during the process of freezing. These two features account for the majority of troubles experienced in bronze founding, and it would appear to be profitable, therefore, to study them closely.

The Solidification Process.

When a mould is filled with molten metal and it begins to cool, the metal in contact with the cold face of the mould cools quicker than the interior. The temperature at which solidification commences is thus first reached by a layer of metal near the mould face, and each layer of metal will reach the temperature at which solidification commences at a later and later time. In the case of a pure metal, which solidifies at a definite temperature, the casting would thus solidify layer by layer as each layer reached the solidification temperature. In the case of bronze, the alloy does not solidify at a definite temperature, but over a range of temperature. It cannot, therefore, form a wall of solid on the outside, gradually thickening to the interior, as in the case of a pure metal. When the outside of a mass of molten bronze reaches the temperature of commencement of solidification, only a portion of the outside layer solidifies, and the bulk of the layer remains liquid until the temperature has fallen considerably below the temperature of commencement of solidification. In the meantime, the next layer into the casting has reached the temperature of solidification and has started to form solid, and so on. In this way it can be seen that solid has started to form a good way into the casting before the first layer has passed through its pasty stage.

The first stage in the freezing of the outer layer is the formation of a network of solid metal, and from this network arms of solid metal then grow into the liquid interior. From these first arms, or dendrites as they are called, as the temperature falls smaller dendrites branch off at right angles, first at the base and then gradually up the length of the shoot. From these secondary branches a third set of branches then begin to grow out again at right-angles. With each fall of temperature the spaces between the branches are being filled in making the trees of solid metal gradually thicker at the bases, while the tops are continually pushing onwards into the liquid. In Fig. 3 is a photomicrograph of a section of bronze polished and etched to show the dendrites.

Now, during this process of freezing, bronze contracts considerably. The solid metal occupies less space than the liquid from which it is formed. The formation of each branch of solid metal tends to leave a space around it. While any liquid metal is available, it will flow up to the dendrites and fill up the space left by the solidification contraction. If for any reason liquid metal is not available, then voids will be left surrounded by solid metal. In the resultant casting these voids will be found in the shape of the outline of the partly-formed dendrites. This is illustrated in Fig. 1, where the contraction cavity shows a dendritic outline. Further proof may be obtained by breaking open a bad casting, when the dendrites may be frequently seen projecting into space.

Contraction cavities will not form if liquid metal is continually available to flow up to the solidifying dendrites. To ensure that each section of a casting, as it freezes, shall be in communication with liquid metal either from a

* A Paper presented to the International Foundrymen's Congress.

thicker section, from a section filled later, and therefore containing hotter metal, or from a runner or riser is no small part of the foundryman's difficult art. Even when a supply of liquid metal is available, it has to flow through a maze of dendrites to fill up all the spaces. It is advisable, therefore, to shorten its path as much as possible, to be sure that it is adequately fluid and that there are no mechanical obstructions to impede its easy flow.

Thus, there are many factors which affect the proper filling up of the cavities left during freezing, and to produce sound castings consistently all these factors must have their proper weight of attention. Unfortunately, few of the important details have been sufficiently worked out by research workers. The foundryman, indeed, has a legitimate cause for complaint that the essential data is greviously lacking. Much of the work which should be put on a quantitative and rational basis is still only guess-work, because that portion which can only be dealt with in the research laboratory has not been investigated.

The Contraction on Freezing.

The whole process hinges on the contraction on freezing, but the exact value of this figure is conspicuously lacking. Recently a few figures

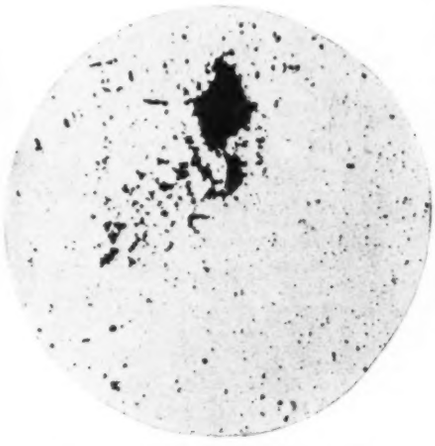


FIG. 1.—POROUS BRONZE. × 25.

for the contraction on freezing for some of the pure metals have been determined, and reliable figures for some of the common alloys, particularly those of low melting-point, have been slowly making their appearance. One still waits in vain, however, for a series of determinations to be made on a range of bronzes and on a scale comparable with that with which other physical properties, such as the tensile strength, are now determined. There seems little prospect of the foundryman being provided with data in the same lavish manner as the engineer. A mass of research work has been expended on the determination of the mechanical properties of the common alloys, and it is by means of these values that a choice is made of each particular alloy for specific service purposes. The foundryman is seldom consulted as to his capacity to produce the necessary castings free from flaws. It remains for him to protest when unsuitable alloys are demanded. But he can only protest feebly that the alloy does not cast well, and for lack of data to make his protest convincing it is often over-ruled with the result that expensive and faulty castings find their way into service. For example, an alloy with a contraction on freezing of only 3 per cent. of its volume would be definitely easier to cast than one with, say, 5 per cent. contraction. There is reason to believe that comparatively small variations in the composition of the bronzes may alter the contraction on freezing to the extent of 2 or 3 per cent., and if a reduction of this order could be secured, it would be a consideration of no small value to the foundryman. Besides increasing his chance of producing sound castings, there would be other savings. For example, smaller runners and risers could be used. The saving in melting-costs on this account alone would go a long way towards paying for some research on the value of the contraction on freezing.

The Temperature Range of Freezing.

If there were no contraction on freezing, then it would be perfectly easy to make good, sound castings, regardless of the cooling rate and the freezing range. The effect of casting temperature, amongst other things, would cease to be of much importance. Practical experience indicates, however, that all commercial bronzes contract on freezing to a greater or less extent, and it is necessary to take account of the freezing range. The longer the freezing range for a given value of contraction and the more difficult it is to cast the alloy free from porosity. It can be appreciated that, if the freezing covers a wide range of temperature, then a considerable depth of metal will be freezing at the same time, and the feeding liquid will have to traverse a thick maze of dendrites to fill up the last cavities. It is thus desirable that the freezing range should be as narrow as possible.

Fortunately, there are more data relating to the freezing range than is the case with regard to the value of the contraction on freezing. The freezing range of bronze depends, of course, on its composition, and the subject is expressed in metallurgical science by means of the equilibrium diagram. Such a diagram is shown in Fig. 4.

The temperature of the beginning and the end of freezing are shown by the two thick lines passing across the diagram. Pure copper, it is seen, starts and finishes freezing at the constant temperature of 1,083 deg. C. The addition of tin lowers the freezing temperature and introduces a range of freezing. For instance, an alloy with 5 per cent. tin starts to freeze at 1,050 deg. C. and an alloy with 10 per cent. tin starts to freeze at 1,000 deg. C. These temperatures are indicated by the points on the top thick line, which corresponds to the compositions 5 per cent. and 10 per cent. tin. The temperature of the end of freezing cannot be read off at once in such a simple manner on account of a certain sluggish behaviour of the bronzes. The diagram is an equilibrium diagram —that is, it represents conditions which would eventually come about if ample time were allowed for all the changes possible to proceed to their conclusion. In ordinary foundry practice bronzes are cooled too quickly to reach equilibrium. In fact, it would need such a slow rate of cooling that the actual solidification of a casting would be spread over several weeks in order to reach equilibrium conditions. If such a slow rate of cooling were possible, then the alloy would finish freezing at the temperature indicated by the point on the lower thick line corresponding to the composition of the particular alloy. Actually, on account of the relatively rapid cooling, the freezing finishes at a point farther to the right of the diagram. Instead of the course of cooling falling down the straight dotted lines, it follows a path, such as is shown by the lines bending off to the right immediately after passing the beginning of freezing. The exact point where the end of freezing is to be found for any particular set of conditions cannot be worked out very easily; it can only be estimated empirically. The curved dotted lines in Fig. 4 for the 5 per cent. and 10 per cent. alloys represent fairly closely the course of freezing for these two alloys when cast in medium-size sand castings under ordinary foundry conditions. The 5 per cent. alloy is seen to finish freezing at about 875 deg. C., while the 10 per cent. alloy finishes at 800 deg. C. The range of freezing for these two alloys is, therefore, about 175 deg. C. and 200 deg. C. respectively.

Effect of Other Metals.

The copper-tin alloys are seldom used in practice in the pure state, but generally have added to them definite quantities of other metals. Few bronzes are cast, for example, without the addition of either zinc or phosphorus. These additions all affect the freezing range of the bronze, and hence need to be considered from the point of view of assisting or retarding the elimination of contraction cavities.

The effect of phosphorus on the freezing range of bronze is greater than that of any of the other usual additions. Small amounts of phosphorus materially lengthen the freezing range by depressing the temperature at which freezing is completed without a proportional lowering of the temperature at which freezing commences. The addition of 1 per cent. phosphorus to a bronze containing 10 per cent. tin lowers the temperature of commencement of solidification from about 990 to about 950 deg. C., that is, by 40 deg. C., and the temperature at which solidification is completed is lowered from about 800 deg. C. in the pure 10 per cent. tin-bronze to about 630 deg. C. for the phosphor-bronze. There is, therefore, a drop of 40 deg. C. in the beginning of freezing and a drop of 170 deg. C. in the end of freezing. The net result, then, of adding 1 per cent. phosphorus to the 10 per cent. pure bronze is to increase its freezing range by 130 deg. C. This is a very serious matter for

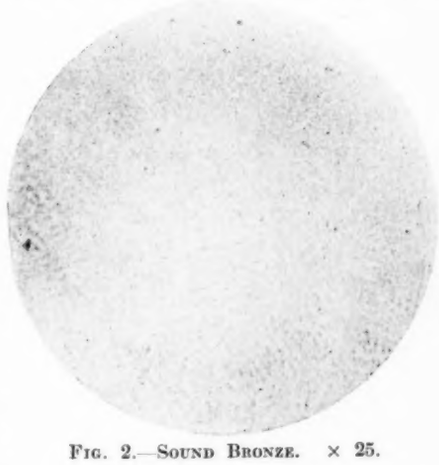


FIG. 2.—SOUND BRONZE. × 25.

the foundryman. A freezing range of 300 deg C.—a common value for phosphor-bronze—makes it exceedingly difficult to produce good, sound castings in sand moulds from such an alloy.

Care must be taken to prevent phosphorus in unexpected amounts finding its way into gun-metal, or it is liable to play havoc with the test results. It is common practice in some foundries to add a little phosphor-tin or phosphor-copper for the purpose of "deoxidising" bronze. Generally good results attend this practice, but in some foundries nothing but disaster follows such additions. This is due to appreciable and unknown quantities of phosphorus being left in the alloy, with consequent lengthening of the freezing range.

Zinc affects the freezing range in the first place by lowering the temperature of the beginning of freezing. A rough idea of the effect of zinc can be had by assuming that each 2 per cent. of zinc has the same effect as 1 per cent. of tin. Thus an alloy with 8 per cent. tin and 4 per cent. zinc would have a similar freezing range to an alloy containing $8 + \frac{4}{2} = 10$ per cent. tin. The exact value of the freezing point can be obtained from an equilibrium model constructed on the lines of the diagram in Fig. 4, but, as this is a rather complicated matter, it will not be dealt with further here.

The Fracture of Bronze.

The metallurgical points which it is so vital to understand before sound bronze castings can be confidently produced have not been adequately discussed in the past, and many failures have been blamed to minor effects. The appearance

of the fracture of a bronze casting in particular appears to have been a fruitful source of misconception, and, on account of the advantage to the practical man in being able to read the fracture correctly, one might advisedly deal at length with this subject.

If a bronze casting is broken open, its fracture will clearly indicate whether the casting is good and strong or whether it is weak and porous. In the latter case, there may be noticed some red and brown patches instead of the clear yellow, somewhat silky appearance associated with sound metal. An explanation of the discoloration, which it would appear slightly ridiculous to mention were it not widely quoted, is that the bronze is not mixed properly. Trade literature, either through ignorance or with a deliberate intention of misleading the foundryman, does not hesitate to trade on this fallacy. One sees advertisements of deoxidisers, fluxes and other rubbish the use of which is alleged to promote proper mixing of the bronze, but which actually has no such effect. For the same purpose one is advised to cast in special moulds, to purchase ingots with a fancy name (and usually at an enhanced price), and to indulge in a variety of other dodges. It can here be stated definitely that it is impossible to melt and pour

Fig. 3.—Dendrites in Bronze. × 25.

bronze in the foundry without invariably securing perfect mixing. There is another aspect of this mixing question. Some foundries make a practice of never using new metal for castings without first ingotting and remelting it. Twice-melted metal is supposed to be better mixed. On the other hand, there are foundries who dislike scrap or ingot metal, and for all but the least important work they insist on new metal only. From the point of view of thorough mixing, there is nothing to choose between either method. It does not matter whether one starts off with new metal, ingots, runners or a mixture of any proportion of scrap and raw metal, the ultimate alloy is bound to be properly mixed.

Another explanation of the peculiar appearance of the fracture of a porous casting is that the metal is oxidised. It must be admitted that this is at any rate a reasonable explanation, since the fracture does appear to show oxide tints. But why should the oxidised metal be confined, as these bad places generally are, to a local area of the section? If the metal is oxidised, surely the oxide tints should permeate the whole section. Sometimes they do, but generally the discoloured area is only local. To avoid this so-called oxidation, one is recommended not to stew the bronze, to melt it rapidly and to use a deoxidiser. All these remedies will, under certain circumstances, help in producing sound castings, but their effect is not due to avoidance of oxidation. For instance, slow melting is supposed to produce oxidised metal. Now, in actual practice, to get rapid melting in the ordinary bronze foundry, working with natural-draft coke furnaces, the draft pressure must be high and the furnace atmosphere must be oxidising. As a matter of fact, there is plenty of experimental evidence that an oxidising atmosphere is essential to produce good-quality bronze. At least, one well-known foundryman has put on record that, where an oxidising atmosphere could not be secured in the furnace, sound castings could not be made unless an oxidising agent was added to the alloy just before casting. He found that, when bronze was melted under reducing conditions, the addition of lead-oxide was necessary to induce soundness.

A false analogy has been drawn between the behaviour of copper and bronze towards deoxidisers, and this has led to the extended use of certain copper deoxidisers in the bronze foundry. Very frequently, however, much money is wasted on these deoxidisers, with no technical gain.

The oxide of copper, which is formed when copper is melted in an oxidising atmosphere, is soluble in molten copper, and, although recent researches have shown that copper oxide is not the bugbear that less enlightened metallurgy believed it to be, yet still, for certain purposes, it is desirable to remove this oxide from the metal. To do this, some element is added which will reduce copper oxide to copper and take to itself the oxygen to form an oxide of the added metal. It is then necessary that the new oxide which is formed should be easily removed as slag, or it should be sufficiently volatile to burn off. If the new oxide is not readily removable, the last state will be worse than the first. There are several available deoxidisers suitable for copper. For example, there is silicon, which, when added to copper containing oxide of copper, reduces the copper oxide to form copper and silicon oxide. The silica is insoluble in copper, and it is much lighter than the molten metal, so that it rises to the surface of the melt, and is either skimmed off or slagged off. There is also phosphorus, which will readily reduce copper oxide, forming an oxide of phosphorus, which again is insoluble in the melt, and readily rises to the top, either to volatilise or to form a slag. Many other materials also may be used, such as manganese, iron and zinc. The essence of the whole process is that the oxide of copper is in solution, and a chemical reaction can therefore readily take place.

Now, in bronze there is an entirely different condition. There are no soluble oxides in the alloy. It can be shown that tin and zinc both reduce copper oxide. In the making of bronze, therefore, copper oxide is reduced, and in its place zinc or tin oxide is formed. These oxides are both insoluble in bronze. Zinc oxide is not only insoluble, but it is not even wetted by the alloy. It is very light, moreover, and it quickly rises to the surface of the melt, where it may be skimmed off. It is only when proper precautions are not observed in skimming and pouring that zinc oxide will be found in the castings. These oxide inclusions are readily apparent without the aid of a miscroscope, and appear as patches of greenish-white sandy material or sometimes looking like a bit of paper which has been screwed up and thrust into the metal. Apart from the unsightliness of such patches of oxide on the machined surface of a casting, it must be remembered that the oxides are of low mechanical strength, and therefore they break up the continuity of the metal and lower its strength. Oxide inclusions may also impede the liquid flow during the freezing and contraction of the casting, and thus lead to porosity.

The elimination of tin oxide is not so easy as it is to free the bronze from zinc oxide, because the tin oxide is nearly as heavy as the metal, and therefore does not readily rise to the surface of the melt, but remains desseminated throughout as insoluble particles. Frequent comment has been passed on the fact that phosphorus, the most popular deoxidiser for bronze, will not reduce tin oxide. As phosphorus is usually only added to the extent of about $\frac{1}{10}$ per cent., it is difficult to see how it can be expected to react with any oxide distributed, as is the tin oxide in the form of fine insoluble particles. A much larger proportion of any reducing metal would be required to react under these conditions.

It is essential, therefore, to prevent oxide finding its way into the casting by mechanical rather than chemical means. The first precaution is to see that the skum from the top of the melt is properly skimmed off. Even then there is the oxide which forms on the stream of metal as it is being poured into the casting, and to prevent this oxide being carried into the mould, choke-runners should be used. Finally, there is a danger of oxide forming during the flow of metal about the mould, particularly where large, flat surfaces are exposed uppermost. Only a modification of the method of running can avoid this trouble.

It is the author's considered opinion that arguments which seek to blame the cause of porosity in bronze castings on to oxides, gas occlusions,

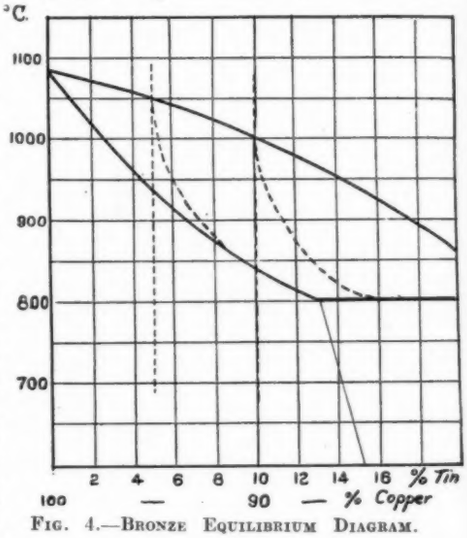
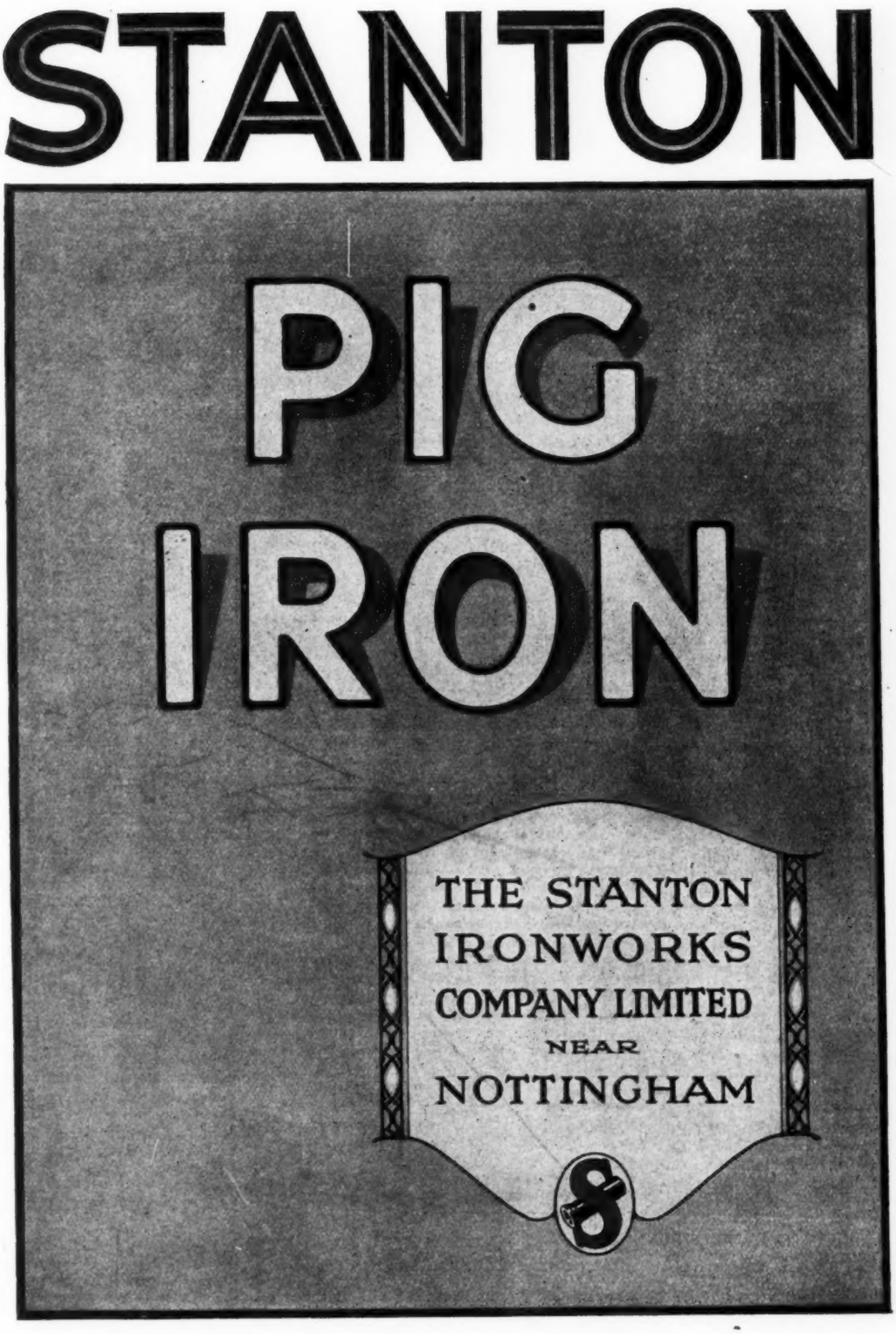


Fig. 4.—Bronze Equilibrium Diagram.

improper mixing or similar secondary matters without full reference to the volume change on freezing and the freezing range are liable to be very misleading; and that these two latter effects are of supreme importance. There seems to have been a general avoidance in the past of any discussion of such a point of view, and on account of this remission there is at present a disappointing paucity of important fundamental data thereon, but if foundrymen were to develop a more sympathetic attitude towards research and a greater freedom in discussing their troubles, there is little doubt that research could quickly be guided into channels of profitable incidence on practice.

Polish Exports of Cast-Iron Pipes.—It is announced that the Polish Government now intends to include cast-iron pipes to be shipped in export trade through the ports of Danzig and Gdynia among the commodities receiving reduced freight rates as a part of the Government subsidy. This action, however, is not so much for the purpose of an export subsidy (since Polish exports of pipe are governed by the so-called International Pipe Syndicate) as to divert the movement of pipes through Polish ports in preference to German. Without preferential rates it is cheaper to ship Polish pipes destined for certain of the Baltic and Scandinavian countries via Hamburg or Stettin than from Danzig or Gdynia. The preliminary official figures of cast-iron pipe exports from Poland during 1928 show a total trade of 57,514 metric tons, most of which is included under the Customs classification "Pipe not separately designated; straight and bent." Of the above total, the largest tonnage was shipped to Germany (13,929 tons); the Dutch East Indies received 9,703 tons, Japan 8,332 tons, Rumania 5,401 tons, and Argentina 2,417 tons. Shipments to the United States during this period were only 763 tons.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Railway Claims.

Difficulties and Remedies.

BY J. W. PARKER, A.M.INST.T.

Often the cause of exasperation and sometimes a source of loss, the question of railway compensation claims for loss or damage to goods sent by rail invariably repays examination. Of the number of deeply rooted, but none the less fallacious, ideas concerning railway claims, perhaps that of foremost importance is the one which argues that only the party paying the carriage may lodge the demand for compensation. In everyday working, the railways have no rule on this point, as they are prepared to deal with either the sender or consignee. Their chief concern is not to pay the same demand twice. Should both sender and consignee lodge a demand, the companies will suggest the withdrawal of one in order to facilitate payment of the other. The question thus becomes one of convenience and practicability. Other things being equal, it is a safe rule for the larger concern to undertake the negotiations, as there is a greater likelihood of their possessing the requisite specialised knowledge and also a larger degree of influence with the carriers than can be commanded by a small undertaking. In instances involving specialised or unusual goods, such as delicate castings, etc., it is generally better for the sender to claim, because he invariably has a closer knowledge of the characteristics and peculiarities of his product than the consignee, and long experience has taught him more about packing and similar processes than can reasonably be expected by either the carriers or the consignee.

It is always a sound rule to inspect every consignment immediately upon receipt, this precaution being necessary on several grounds. In the first place, the giving of a qualified signature on the railway company's delivery sheet, as, for instance, "not examined," or even a specific remark as to damage, is not complete protection. It must be followed up by intimation to the company within three days, whilst the claim itself must be made within seven days. Secondly, the consignment may be in apparent good condition outwardly, but a subsequent examination, when it is too late to sustain a successful claim, may reveal breakages or other unsatisfactory features. On this account progressive firms always make a thorough examination of goods immediately they are received, regardless of whether they are required or not. For certain items, machinery in particular, it is impossible to assess the amount of damage within the limited period allowed for claims being lodged. Lack of this knowledge should not be permitted to hold up the demand, as it may be passed to the railway without this item or an estimated sum inserted, which can be corrected when the exact figure is known.

Of equal importance in all instances of breakage or damage is it to give the railway people an opportunity of examining the consignment. To this end the packing cases, crates, etc., should be preserved until they have been inspected by the carriers' representative. Neglect of these precautions often leads to complications and needlessly prolongs the investigations, besides tending to prejudice the ultimate settlement. By making a prompt investigation, the railway authorities are at times able to effect repairs or furnish replacements of broken parts. In settling a claim, they are entitled to take possession of any remains or damaged portions under the heading of salvage, or, if preferred, the trader may make an allowance or deduction from the total.

In drawing up his demand, the claimant should take into account the amount of carriage paid, otherwise he is going to be out of pocket over the transaction.

When a large number of very small claims is involved, some firms find by experience that the amount of trouble and investigation is not worth the results obtained, consequently they come to an agreement with the railways that they do not claim for damages of, say, under eighteenpence or two shillings.

The investigation by the railway prior to paying claims often takes such a long period as to lead claimant to overlook his demands unless some systematic record is kept of them and periodical reminders issued. Damages for substantial sums, involving more than one railway, cannot be settled except by reference to the Joint Claims Committee of the Railway Clearing House, a procedure which tends to delay payment. None the less, it is desirable to adopt a practice whereby the progress of claims in hand is kept before the railway companies' notice, as only by so doing can the trader prevent some amount of his capital from being needlessly locked up and rendered unproductive.

A practice adopted by a number of firms in the engineering and foundry trades is to charge their customers carriage at the higher, or company's, risk rate, but to consign them at the lower, or owner's, risk rail rates. By doing this they secure to themselves the difference between the two rates, but at the same time they take the risk of damage, which, should it occur, cannot be subject to compensation from the carriers. "Owner's risk" is a matter calling for more than passing attention. The essential difference between goods sent at company's risk and those at owner's risk is that under the latter the railways are not responsible for their own or their servants' negligence. They are, however, liable for wilful misconduct. The matter is not left at this point, as several exceptions have a softening effect in certain instances. Liability attaches to the carriers of goods at owner's risk in respect of non-delivery of the whole or a portion of the consignment, unless fire or train accidents be the cause. The second exception is pilferage, unless this has happened to packages covered with paper or other easily removed packing. The last exception which makes the railways liable is misdelivery in those instances where properly addressed goods are not tendered for delivery within 28 days of despatch. If the carriers can prove the non-delivery, pilferage or mis-delivery has not been due to their own negligence or misconduct, they are able to escape liability. It will thus be seen that the chances of recovering compensation in connection with owner's risk traffic depends upon ability to satisfy some fairly rigorous requirements.

From whatever point of view claims are regarded, they cannot be considered satisfactory. The carriers have a definite loss to meet, the sender has often to replace a consignment, whilst the consignee is prejudiced or annoyed by receiving a damaged article. All parties have to undertake a certain amount of unremunerative correspondence and inquiries. Realising this aspect of the matter, the railways during recent years have devoted an increasing amount of attention to claims *prevention* work. At first this movement was confined to improving their own handling arrangements and internal organisation, such as educative work amongst the station and lineside staff, the reduction of transhipping and provision of improved equipment. At a later date a distinct tendency to co-operate with traders manifested itself. Instances of this are found in the introduction of locked vans and the provision of containers, which not only reduce packing weight and cost, but give improved protection with much less handling at all stages of the transit.

Cast-Iron Pipe Contracts for South America.

The Stanton Ironworks Company, Limited, near Nottingham, have succeeded in obtaining two important contracts for cast-iron pipes for delivery to South America; the one for some forty miles of pipe for the Monte Video Water Supply, and the other for ten miles for Rosario Water Supply. The pipes in both cases are chiefly in large diameters.

One-Piece Locomotive Frames.

According to "The Railway Gazette" further developments are taking place in the United States and Canada in connection with the use of one-piece locomotive "chassis" or beds, in which the main frames, cylinders, steam chests, etc., are formed in one individual casting. At the present time 17 American and Canadian railways are employing this construction. The Commonwealth Steel Company, of Granite City, Illinois, U.S.A., are designers and sole manufacturers of these locomotive beds, which are of the 4-6-4 type.

These engines have cylinders measuring 25 in. by 28 in. set at 7-ft. 5-in. centres, the length of the bed overall being 49 ft. 6½ in., and the weight approximately 18 tons 15 cwts. 3 qrs. The bed combines in one piece the main and rear frames, all cross-ties, boiler supports, deck castings, brackets for supporting brake and spring rigging, cylinders, steam chests, and smokebox saddle.

In the case of a similar construction, used to replace a built-up framework on some locomotives of the 2-8-0 type, the complete frame structure with the bed casting consisted of but 41 parts, or less than one-fifth of the number in the built-up structure replaced, which had 233 parts. The cylinders and valve chambers are arranged for cast-iron bushings, and all wearing parts are renewable. The beds are supplied with separate cylinders if desired.

The manufacturers call attention to a feature which they regard as particularly valuable—namely, the ability substantially to increase the strength of the frame structure without increasing its weight. Consequent upon this, a saving of several thousand pounds in weight was made in the case of the Missouri Pacific locomotives. With the elimination of all bolted connections the frame is made more rigid, and the cost of maintaining such connections eliminated.

Similar locomotive frame castings have been supplied to a number of American railways for new and rebuilt locomotives, the engines in all cases belonging to large and powerful types. An earlier example was illustrated and described in the issue of THE FOUNDRY TRADE JOURNAL, dated April 7, 1927.

Newcastle Section Organise Annual Outing.

The Newcastle Branch of the Institute of British Foundrymen has arranged for the Summer Outing to take place on Saturday, July 13. Motors leave Newcastle for Otterburn at 2 p.m., and the outward journey will be via Porteland and Belsay. Tea will be served on arrival, and the return journey will be made via Bellingham and Hexham. The circular tour of 70/80 miles embraces a great variety of scenery, and includes a wonderful stretch of Northumbrian moorland. The charge will be 7s. per head, and the President (Mr. R. H. Smith, of South Shields) and Council hope that there will be a good attendance of members, ladies and friends. Applications for tickets should be sent to the Honorary Secretary, Mr. F. Sanderson, 1, Ellwood Gardens, Gateshead-on-Tyne, not later than July 6.

ON SATURDAY, June 8, the Lord Mayor of Newcastle, Mr. Arthur W. Lambert, unveiled a bronze tablet at the cottage at Wylam-on-Tyne, where George Stephenson, the inventor of the locomotive, was born on June 9, 1781. Stephenson's famous locomotive "Rocket" is shown on the tablet, which bears the following inscription: "George Stephenson, 1781-1848, born in this house June 9, 1781. This tablet was erected by the Institution of Mechanical Engineers, of which he was the first president, and by the North-East Coast Institution of Engineers and Shipbuilders, unveiled by the Lord Mayor of Newcastle, June 8, 1929, the year of the centenary of the success of the 'Rocket' at Rainhill."

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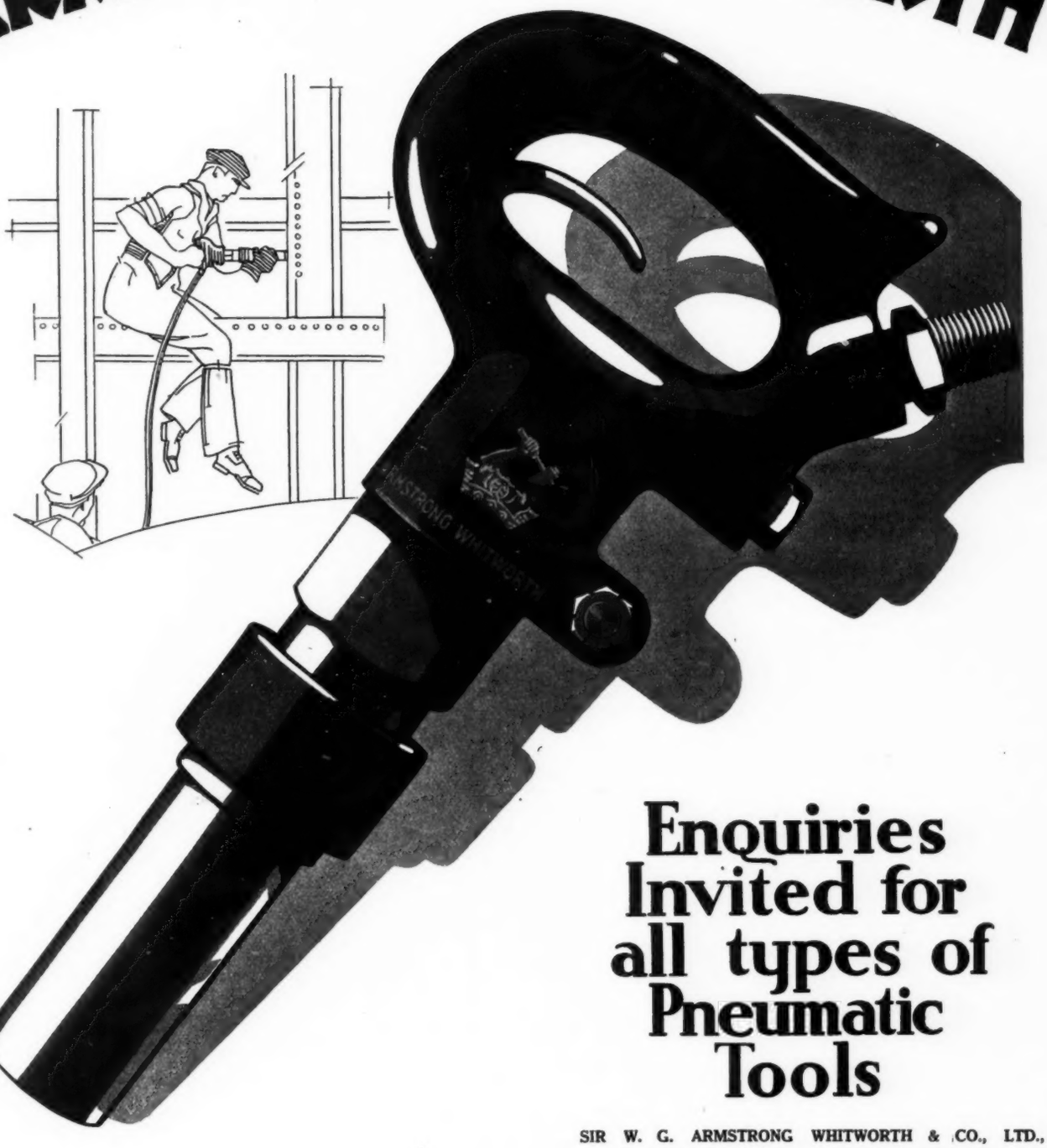

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Trade Talk.

A third open-hearth steel furnace was started recently at the Redbourne Works, Scunthorpe, of Messrs. Richard Thomas & Company, Limited.

The Widnes Foundry (1925), Limited, have received the contract for the supply of cast-iron work for the New India Building in Water Street, Liverpool.

It is understood that the Cargo Fleet Iron Company, Limited, Middlesbrough, have received a substantial order for steel rails from the Union of South Africa.

An order for a steamer of 8,250 tons has been placed with Messrs. J. L. Thompson & Sons, Limited, Sunderland, by the Strath Steamship Company, Limited, of Cardiff.

The Belgian zinc-sheet industry has established a trade organisation, with headquarters in Brussels, which will fix selling prices. The new organisation will begin operations on July 1.

Work on the new Olympia Hall, in London, a steel structure, has begun. It is intended to complete the building in time for the annual British Industries Fair, which is to be held in February.

Thomas E. Gray & Company, Limited, 119, High Holborn London, W.C., have been appointed sole agents in Great Britain for the line of moulding machines manufactured by Gustav Zimmermann, of Düsseldorf-Rath, Germany.

The British Senior Trade Commissioner in Canada has forwarded a copy of the standard specification for carbon-steel castings issued by the Canadian Engineering Standards Association. This publication is available for loan to firms interested upon application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, have secured a contract for the construction of a motor-driven oil tanker of 8,800 tons deadweight for Norwegian owners. The vessel will be fitted with six-cylinder Armstrong-Sulzer two-stroke Diesel engines, which will be constructed at the company's Scotswood Works, Newcastle-on-Tyne.

The Metropolitan-Vickers Electrical Company, Limited, removed their Newcastle office on Monday last to Metro-Vick House, Northumberland Road, Newcastle-on-Tyne, where much greater warehouse and office accommodation will be available. The company's new showroom is not yet complete, and they are continuing at their present address in Saville Row for showroom purposes until the end of August.

An official report issued at the close of a meeting at Swansea last week of the joint standing committee of the South Wales Siemens Steel Trade Conciliation Board states that a number of important trade claims came up for discussion, together with the reports of a number of sub-committees. After a protracted discussion certain claims were definitely turned down, and others, including one for the adjustment of the present ex-gratia bonus, were referred to various committees.

Messrs. John Butler & Company, Limited, of Stanningley Ironworks, Leeds, are to close their works in a few months' time owing to the bad condition of trade. The works were established more than 100 years ago, and the managing director states that they are closing because it has been found impossible to make a reasonable profit. It appears unlikely, however, that the works will be shut down for some months, as a number of contracts remain to be finished. At one time the firm employed more than 1,400 persons.

The London Midland & Scottish Railway Company have just placed with the United Steel Companies, Limited, a trial order for 10,560 pressed-steel railway sleepers of the Sandberg heavy type, weighing 190 lbs. each, a total of between 800 and 900 tons of sleepers. The London & North Eastern Railway Company have also placed with the United Steel Companies, Limited, a trial order for 500 tons, or nearly 6,000 railway sleepers, each weighing 192 lbs. These orders follow one received by the United Steel Companies, Limited, early in the year from the Southern Railway, for 5,000 tons of Sandberg steel sleepers.

President of Russian Machinery Syndicate in London.

Manufacturers of machinery may be interested to learn that Mr. N. D. Koniukhov, President of the Russian Machinery Syndicate, is in this country on business, and may be communicated with c/o Industrial Newspapers, Limited, 49, Wellington Street, Strand, London, W.C.2.

Company News.

Henry Gardner & Company, Limited.—At a meeting of Messrs. Henry Gardner & Company, Limited, held last week in London, a scheme for the reorganisation and consolidation of the capital of the company was unanimously approved. Mr. Henry Gardner, the chairman, who presided, said that if the scheme was carried through, the holder of partly-paid shares, if he took up and paid for his retained portion of the new shares, would hold six fully-paid shares for every ten partly-paid shares now held. It would have been more simple to have increased the capital by the amount required for the purpose in view, but that would have perpetuated two classes of shares as well as the liability on part of the issued capital. It was desirable to get rid of the liability and have one class of share only. The scheme as a whole was for the present and ultimate benefit of all the shareholders.

British Dardelet Threadlock (D.D.G.) Corporation, Limited.—The statutory meeting was held in London last week. Mr. Eustace C. Quilter, who presided, said that as soon as the company was formed, a detailed survey was made of the bolt and nut trade in this country as a basis for deciding on the company's policy. Bolts and nuts occupied a much more important place in engineering than was generally realised, while it was also true that progress in their design and manufacture had hardly kept pace with modern engineering development. The Dardelet thread was a solution of a problem which had received the attention of engineers and inventors for years past. The Dardelet invention was very simple in principle, but it required careful and accurate manufacture, and that was one of the reasons for the decision to commence manufacture in their own factory. The directors had decided on the erection of a factory at Acton.

Callender's Cable and Construction Company, Limited.—Sir J. Fortescue Flannery, Bt. (chairman), presided at the annual meeting. He said that during 1928 there was some restriction on the electrical cable industry, and few large contracts were placed for the heavy mains which were essential for the widespread distribution of electricity. Most of those engaged in electrical supply held their hands pending the completion of the Government scheme. The details of the grid were now known, and several contracts had been placed in connection with it. A contract representing a value of approximately £500,000 had been secured by the company. The orders obtained by the company for the ordinary run of underground cables and for the wires and cables required inside premises represented a highly satisfactory business which continually tended to increase. The company's overseas business during the past year was satisfactory, and it continued to progress. The chairman referred to the acquisition of the business of W. T. Glover & Company, Limited, and, continuing, said that the directors proposed to take £186,000 from the reserve funds of the company and distribute it in fully paid up ordinary shares. The company had in reserve and carry forward a sum of approximately one million pounds. The shareholders might reasonably expect some of this substantial accumulation of profits to be distributed among them, and the directors had therefore decided to capitalise £186,000. This would mean that for every five shares a shareholder possessed he would receive without cost to himself one extra share.

Reports and Dividends.

Alley & MacLellan, Limited.—Profit, £25,671; brought in, £19,236; depreciation, £8,879; carried forward, £32,368.

Guest, Keen & Nettlefolds, Limited.—Final dividend on the ordinary shares of 1s. per share, making 10 per cent., tax free, for the year.

Cleveland Bridge and Engineering Company, Limited.—Interim dividend at the rate of 5 per cent. per annum on the preference and ordinary shares, free of tax on the latter.

Ruston & Hornsby, Limited.—Net profit, £82,709; brought in, £24,157; preference dividends, £23,500; dividend of 2½ per cent., tax free, on the ordinary shares, £51,250; carried forward, £32,116.

Manley & Regulus, Limited.—Profit, £27,497; maintenance and depreciation, £3,964; brought in, £7,923; preference dividend, £1,400; to general reserve, £4,125; income-tax reserve, £5,000; final dividend of 10 per cent. on the ordinary shares, plus a bonus of 2½ per cent., both less tax, making 22½ per cent. for year; carried forward, £8,698.

Contracts Open.

Blessington, Ireland, June 24.—Cast-iron water main, for the County Health District Board. Mr. P. W. Sheehan, secretary, Board of Health Office, Rathdrum.

Burrinjuck, N.S.W., August 12.—Hydro-electric generating plant, for the New South Wales Department of Public Works. The Department of Overseas Trade. (Reference No. B.X. 5,365.)

Carmarthen, July 2.—Steel footbridge, for the Town Council. The Borough Surveyor. (Fee £1, returnable.)

Johannesburg, July 25.—Pig-iron and ferro-manganese, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 8,062.)

Johannesburg, July 25.—Structural steel work, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 8,061.)

London, S.E., June 28.—Buffers, drawbars, wheels and axles, etc. The India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

London, S.E., July 2.—12 locomotive boilers with cylinders, etc. The India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

London, S.W., June 24.—50 sluice valve fire hydrants, with surface boxes, for the Merton and Morden Urban District Council. Mr. C. J. Mountifield, clerk, 126, Kingston Road, Merton, S.W.19.

Loughborough, Leics.—472 yds. of 15-in. and 112 yds. of 12-in. cement-lined spun cast-iron water mains, including valves, hydrants, etc., for the Corporation. Mr. A. H. Walker, waterworks engineer, Town Hall, Loughborough. (Fee £2 2s., returnable.)

Margate, June 25.—400 cast-iron railing standards, for the Town Council. The Borough Surveyor, 40, Grosvenor Place, Margate. (Fee £2 2s., returnable.)

Montevideo, August 17.—One hand-operated overhead travelling crane, for the Uruguayan Administration of Ports. The Department of Overseas Trade. (Reference A.X. 8,037.)

Redruth, July 1.—Three and a-half miles of 9-in., 8-in. and 6-in. cast-iron water mains, etc., for the Redruth Urban District Council. Mr. T. F. King, Council Chambers, 2, Station Hill, Redruth. (Fee £3, returnable.)

New Companies.

A. Palmer & Company (Engineers), Limited.—Capital £2,000. Secretary: W. Smith, 31, Holtwood Road, Sheffield.

J. H. Hawes, Limited, 12, Kentish Town Road, London, N.W.—Capital £1,500. General engineers, etc. Directors: J. H. Hawes and A. G. Cross.

Obituary.

Mr. Alfred Burch, chairman of Messrs. Bradley & Burch, Limited, iron and steel and metal merchants and machinery agents, of London, died on Friday, June 7.

Mr. R. C. Green, managing director of Messrs. Green & Hughes, Limited, bolt and nut manufacturers, of Oldbury, and joint managing director of Messrs. Samuel Wheeler, Limited, metal workers, Smethwick, died recently in his 54th year.

Personal.

Sir Charles Wright has been elected a director of the German Mannesman Tube Works at Düsseldorf.

Mr. Charles D. Rigg, who for a number of years has been a steel salesman for Messrs. David Colville & Sons, Limited, has been appointed assistant commercial manager of the sheet department of Messrs. Smith & McLean, Limited.

Wills.

Abel, R. P., of Letchworth, a director of the Kryn & Lahy Metal Works, Limited	£11,057
Smedley, T. F., of Messrs. Smedley Bros., Limited, engineers and iron-founders, Belper	£10,914

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—Conditions in the Cleveland iron market, as at present existing, may be justifiably described as without parallel in the history of the trade, there existing a steadily expanding demand for foundry material, with ample furnace-plant resources available, but which is idle consequent upon the scarcity and high costs of raw material and fuel essential for increased production. So far, the problem discloses no immediate solution, and foundry iron is now practically unobtainable in the Tees-side market. Stocks in makers' yards have been completely exhausted for some time past, while reserves in merchants' stocks have also diminished to vanishing point. In the circumstances, thus briefly outlined, competition from outside sources is also growing, and recently a big purchase of Northamptonshire iron has been negotiated by a Cleveland firm having its own blast furnaces. Market quotations, consequently, are difficult to define with any degree of exactitude, makers intimating that, when they have any iron to sell, their price for No. 3 Cleveland G.M.B. will be not less than 72s. 6d., and that may now be indicated as an approximate ruling figure. On this basis, No. 1 foundry iron would be 75s. per ton, No. 4 foundry 71s. 6d. and No. 4 forge 71s.

The market for East-Coast hematite, in curious contrast to that for foundry pig, is well provided with supplies, except perhaps for June delivery, outputs of furnaces having been expanded as the demand has increased, a movement tending to check an advance in selling prices, it being still possible to place contracts for July/August at 74s. per ton for mixed numbers, with the usual 6d. per ton extra for No. 1 quality. On the North-West Coast the price is still firmly fixed at 75s. per ton at works.

LANCASHIRE.—A somewhat more active buying interest is reported in markets for foundry iron in this area, Lancashire foundries continuing to take good supplies at current prices, as follow:—Staffordshire and Derbyshire brands, 73s. and 72s. respectively, with Scottish qualities quoted at about 92s., all per ton delivered Manchester or equal.

THE MIDLANDS.—A gradual and steady improvement in demand for foundry pig in this area has been a marked feature of late, and is confirmed by the fact that a number of consumers are renewing contracts which have recently lapsed, and altogether there has been a considerable amount of business placed with Midland furnaces. As a consequence, prices are very firm, and in some cases the zone minimum figure is not accepted. The minimum zone prices are 73s. 6d. for Derbyshire No. 3, 74s. 6d. for North Staffordshire No. 3, and 70s. for Northants No. 3, delivered local stations.

SCOTLAND.—The volume of trade passing in Scotch pig-iron is at present very poor, and at the moment there is no improvement in sight. With one or two exceptions, founders seem to be exceedingly quiet, and their demands for pig-iron are correspondingly small. The official minimum price of No. 3 Scotch foundry is 74s. 6d. per ton, f.o.t. furnaces.

Finished Iron.

Although home demands for most classes of finished material are still disappointing, it is satisfactory to learn from the latest official returns that our export trade in this section shows a marked improvement, giving hopeful indications of still further growth in the near future. At Birmingham this week there has been no change in the prices of the various grades of Staffordshire iron. Crown quotations vary from £9 10s. to £10 per ton, according to the make and nature of specification, while nut and bolt iron, for which the demand is negligible, is at about £9 to £9 2s. 6d. Marked bars are unchanged at £12 at makers' works, and the makers of this grade of iron continue to be fairly well occupied. Although the call for crown iron is slightly improved, it is still far from being of satisfactory extent, and at the moment new business is very difficult to get. There is little support possible to the makers of nut and bolt iron in face of the continued competition from the Continent.

Steel.

At Sheffield this week the demand for basic billets is well maintained, and is, if anything, inclined to expand, but there is no improvement in acid-quality sales. The recent increases recorded in the quotations for billets has now been followed by higher prices for basic and acid wire rods. Current prices:—Basic billets: Soft, £7; medium, £8 2s. 6d.; hard, £9 2s. 6d. to £9 12s. 6d.; Siemens acid billets, £9 10s.; wire rods, soft basic, £8 7s. 6d. to £8 10s.; medium hard, £9 10s. to £10; hard, £10 15s.; acid, £12 5s. to £12 10s.; steel hoops, £9 10s. to £9 15s. Conditions in the finished-steel department are irregular, and, while some of the British works have good order books, others are rather short of orders. The falling-off in new shipbuilding contracts, however, has caused some disappointment. In the tinplate market sales made are almost entirely for near dates at figures ranging around 18s. 3d. basis, f.o.t. at works, for usual lines.

Scrap.

Reports from the various centres of consumption of scrap metals indicate a moderately active business, and in the Midlands there is a good demand for heavy cast-iron scrap, 72s. 6d. being offered for machinery quality in cupola sizes. Light cast-iron scrap is easier at 57s. 6d. delivered. On the North-East Coast the increasing activity of the foundries is reflected in the growing call for heavy cast iron at 65s. per ton for ordinary quality, with machinery grade at 67s. 6d. In Scotland there are few buyers of machinery cast iron at 71s. 3d. to 72s. 6d.; heavy ordinary cast iron is quoted at 65s., light cast-iron scrap is at 66s. 3d. to 67s. 6d., and cast-iron railway chairs are unchanged at 67s. 6d. to 68s. 6d. The ironworks are not buying very large quantities of scrap at the moment. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—Following the recent unsettled conditions, markets for warrant copper have developed a much more active buying interest, with a corresponding appreciation of current values. The demand from home consumers, however, still remains very limited, but better sales have been reported on the Continent of late, particularly in Germany. This better inquiry from Continental consumers is due partly to the settlement of the reparations question and to the fact that any hesitancy caused by the General Election in this country is now ended.

Closing quotations are :—

Cash.—Thursday, £76 2s. 6d. to £76 5s.; Friday, £75 15s. to £75 17s. 6d.; Monday, £75 2s. 6d. to £75 3s. 9d.; Tuesday, £74 13s. 9d. to £74 15s.; Wednesday, £73 7s. 6d. to £73 10s.

Three Months. — Thursday, £74 15s. to £74 17s. 6d.; Friday, £74 12s. 6d. to £74 15s.; Monday, £74 15s. to £74 17s. 6d.; Tuesday, £74 10s. to £74 11s. 3d.; Wednesday, £73 12s. 6d. to £73 15s.

Tin.—During the past week, after again reaching the £200 level, prices of standard tin reacted to limited extent, closing, however, fractionally below that figure. This improvement in conditions was mainly due to the fact that representatives of the various producing interests are now getting together, and the possibility of some co-operative action with the purpose of curtailing the production seems now less remote than when the idea was first originated some time ago. As a result, values have been firmer.

Official closing prices :—

Cash.—Thursday, £198 7s. 6d. to £198 12s. 6d.; Friday, £197 15s. to £197 17s. 6d.; Monday, £201 to £201 2s. 6d.; Tuesday, £201 5s. to £201 7s. 6d.; Wednesday, £201 10s. to £201 15s.

Three Months.—Thursday, £201 7s. 6d. to £201 12s. 6d.; Friday, £200 17s. 6d. to £201; Monday, £204 5s. to £204 7s. 6d.; Tuesday, £204 12s. 6d. to £204 15s.; Wednesday, £204 17s. 6d. to £205.

Spelter.—Confidence in the spelter market has tended to lessen of late, and as a result values are inclined to fall. These conditions, however, are only the natural outcome of the present state of affairs, supplies of prompt metal available being ample and in excess of the present trade requirements.

Daily quotations are :—

Ordinary. — Thursday, £26 3s. 9d.; Friday, £26 3s. 9d.; Monday, £26 1s. 3d.; Tuesday, £26 3s. 9d.; Wednesday, £26 2s. 6d.

Lead.—Imports of soft foreign pig still continue ample for all requirements, and, although the home trade has been satisfactory, consumers seem to be working on their present stocks and withholding their replacing orders. Good business, however, has been reported on the Continent, with Germany as the chief buyer. In these circumstances, any advance in prices in the near future would appear unlikely.

Prices have been :—

Soft Foreign Prompt.—Thursday, £23 11s. 3d.; Friday, £23 12s. 6d.; Monday, £23 13s. 9d.; Tuesday, £23 18s. 9d.; Wednesday, £24.

Students' Corner

Q.—What is a "scab"?

A.—A foundry scab is a rough place on a casting due to the removal of sand forming the mould or core.

Q.—What is the cause of a scab, or scabbing?

A.—There are several causes that contribute to this. The following are a few of them: (1) Insufficient porosity and permeability in the sand or loam; (2) Insufficient venting; (3) Inadequate air channels and receivers to relieve the pressure of the expanded air, and generated gases, such as an abundance of cinders in cores, and coke beds for the moulds, and obstruction in the air passages; (4) Excessive dampness. (It is common for moulds and cores to blow and scab due to this), and (5) Hard ramming in the presence of moisture makes the sand impermeable.

Q.—Actually, how is a scab formed?

A.—When a mould is being poured with molten metal and comes into contact with any of the conditions enumerated, small, or large explosions occur and recur very rapidly wherever the air may be confined. This eruptive state is continued so long as the molten metal remains in that state. Hence, each tiny rapid puff dislodges the grains of sand because the air cannot pass through the wall of sand, and due to this action being rapidly repeated, the result is either a large or small rough, dirty place is formed where there should be a smooth surface. The sand that is removed by this action is somewhere in the casting. In other words, there are lumps and holes in the wrong places. Where there is excessive moisture, quite large pieces of the mould or core are pushed into the mould space during the time the metal is in the plastic state, which is due simply to the change from water to steam, and often this state is accompanied by the metal blowing through the runner gates and rises to such an extent, that occasionally the molten metal is lifted high in the air, causing damage and injury. Under such conditions the violent action of the metal destroys the mould, and the casting whether large or small is invariably a waster.

Q.—What are the best preventives from scabbing and blowing?

A.—A suitable mixture and preparation of sand for moulds and cores and intelligent ramming; where necessary, free use of the vent wire, whilst an abundance of cinders and coke beds for core and moulds to receive the pressure of the air and gases; a minimum of sleeking with a smooth tool; the maximum use of the hand and fingers when finishing a mould or core, and a limited use of the water brush and swab.

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Write for Illustrated Catalogue on Blacking and Foundry Requisites.

What Sirocco Service means to you

Submit your Fan Problems to us.

When you instal a

...TRADE... SIROCCO ...MARK...

FAN

It means that you have the knowledge and experience gained from thousands of different Fan applications brought to bear upon your particular problem. We are equally interested in the efficient working of your Fan Installation and our Engineers are always ready to advise you how to obtain the best results.

DAVIDSON & CO. LIMITED.
Sirocco Engineering Works.
BELFAST

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	73	7	6
Three months	73	12	6
Electrolytic	83	15	0
Tough	77	5	0
Best selected	77	10	0
Sheets	110	0	0
India	93	0	0
Wire bars	84	12	6
Do. July	84	12	6
Do. Aug.	84	12	6
Ingot bars	84	12	6
H.C. wire rods	86	17	6
Off. av. cash, May	75	2	6
Do. 3 mths., May	73	9	6 9/11
Do., Sttlmnt., May	75	2	4 7/11
Do., Electro, May	84	2	5 5/11
Do., B.S., May	76	19	8 3/4
Aver. spot price, copper, May	75	2	6
Do. wire bars, May	84	10	4 1/11

Solid drawn tubes 15½d.
Brazed tubes 15½d.
Wire 12½d.

BRASS.

Solid drawn tubes 13d.
Brazed tubes 15d.
Rods, drawn 12½d.
Rods, extd. or rlld. 8½d.
Sheets to 10 w.g. 11½d.
Wire 11½d.
Rolled metal 10 7/8d.
Yellow metal rods 8½d.
Do. 4 × 4 Squares 9d.
Do. 4 × 3 Sheets 9½d.

TIN.

	£	s.	d.
Standard cash	201	10	0
Three months	204	17	6
English	202	5	0
Bars	203	15	0
Straits	204	10	0
Australian	203	5	0
Eastern	207	10	0
Banca	208	15	0
Off. av. cash, May	197	12	8 5/11
Do., 3 mths., May	200	2	11 5/11
Do., Sttlmt., May	197	12	11 5/11
Aver. spot, May	197	12	8 5/11

SPELTER.

Ordinary	26	2	6
Remelted	24	5	0
Hard	21	5	0
Electro 99.9	29	0	0
English	26	10	0
India	22	15	0
Zinc dust (Nom.)	36	0	0
Zinc ashes	9	0	0
Off. aver., May	26	13	4 1/11
Aver., spot, May	26	14	6 5/11

LEAD.

Soft foreign ppt.	24	0	0
English	25	5	0
Off. average, May	23	16	11 11/22
Average spot, May	23	18	11 5/11

ZINC SHEETS, &c.

Zinc sheets, English	35	0	0
Do. V.M. ex whf.	33	7	6
Rods	42	0	0
Boiler plates	31	0	0
Battery plates	32	0	0

ANTIMONY.

Special brands, Eng.	50	5	0
Chinese	33	15	0
Crude	Nominal		

QUICKSILVER.

Quicksilver 22 3 9

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—			
25%	7	15	0
45/50%	12	0	0
75%	19	10	0

Ferro-vanadium—
35/50% ..13/- lb. Va.
Ferro-molybdenum—
70/75% c. free 3/10 lb. Mo.
Ferro-titanium—
23/25% carbonless 11d. lb.
Ferro-phosphorus, 20/25% £16 0 0
Ferro-tungsten—
80/85%, c. fr. 2/9 lb.
Tungsten metal powder—
98/99% 2/11 lb.
Ferro-chrome—
2/4% car. £32 10 0
4/6% car. £23 15 0
6/8% car. £23 2 6
8/10% car. £22 17 6
Ferro-chrome—
Max. 2% car. £34 0 0
Max. 1% car. £37 12 6
Max. 0·70% car. £41 12 6
70% carbonless 1/2 lb.
Nickel—99% cubes, or pellets £175 0 0
Ferro-cobalt 9/4 lb.
Aluminium 98/99% £95 0 0
Metallic chromium—
96/98% 2/6 lb.
Ferro-manganese (net)—
76/80% loose £13 15 0
76/80% packed £14 15 0
76/80%, export £14 10 0
Metallic manganese—
94/96%, carbonless 1/6 lb.
Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten £0 2 0
Finshed bars, 18% tungsten £0 2 9
Per lb. net, d/d buyers' works.
Extras—
Rounds and squares, 3 in. and over 4d. lb.
Rounds and squares, under ½ in. to ¼ in. 3d. lb.
Do., under ¼ in. to 5/16 in. 1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ¾ in. 3d. lb.
Do., under ¼ in. × ¼ in. 1/- lb.
Bevels of approved sizes and sections 6d. lb.
Bars cut to length, 10% extra

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy steel				3	18	0
Bundled steel and shrngs	3	15	0 to	3	17	6
Mixed iron and steel				3	12	6
Heavy cast iron	3	3	6 to	3	5	0
Good machinery for foundries				3	10	0
Cleveland—						
Heavy steel				3	5	0
Steel turnings				2	17	6
Cast iron borings				2	17	6
Heavy forge				3	17	6
W.I. piling scrap				3	12	6
Cast-iron scrap	3	5	0 to	3	7	6
Lancashire—						
Cast-iron scrap	3	2	6 to	3	10	0
Hvy. wrought				3	15	0
Steel turnings				2	17	6
Scotland—						
Heavy steel				3	15	0
Cast-iron borings				2	14	6
Wrought-iron piling				3	12	6
Heavy machinery				3	11	6

London—Merchants' buying prices delivered yard.

Copper (clean)	62	0	0
Brass	41	0	0
Lead (less usual draft)	21	0	0
Tea lead	17	10	0
Zinc	17	0	0
New aluminium cuttings	67	0	0
Braziery copper	54	0	0
Gunmetal	53	0	0
Hollow pewter	140	0	0
Shaped black pewter	105	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—

Foundry No. 1	75/-
Foundry No. 3	72/6
Foundry No. 4	71/6
Forge No. 4	71/-
Hematite No. 1	74/6
Hematite M/Nos.	74/-

N.W. Coast—

Hem. M/Nos. d/d Glas.	83/6
,, d/d Birm.	91/-

Midlands—

Staffs. common*	—
,, No. 4 forge*	70/6
,, No. 3 fdry*	74/6
Shrops. basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	66/-
,, fdry. No. 3*	70/-
Derbyshire forge*	69/6
,, fdry. No. 3*	73/6
,, basic*	—

* d/d Black Country dist.

Scotland—

Foundry No. 1	77/-
,, No. 3	74/6
Hem. M/Nos.	78/-

Sheffield (d/d district)—

Derby forge	64/6
,, fdry. No. 3	68/6
Lincs. forge	—
,, fdry. No. 3	72/6
E.C. hematite	86/-
W.C. hematite	87/-

Lincs. (at furnaces)—

Forge No. 4	—
Foundry No. 3	—
Basic	—

Lancashire (d/d eq. Man.)—

Derby forge	—
,, fdry. No. 3	72/-
Northants foundry No. 3	—
Dalzell, No 3 (special)	102/6 to 105/-
Summerlee, No. 3	92/-
Glengarnock, No. 3	—
Gartsherrie, No. 3	92/-
Monkland, No. 3	92/-
Shotts, No. 3	92/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.) nom.				10	15	0
Nut and bolt iron	9	0	0 to	9	2	6
Hoops	11	0	0 to	11	10	0
Marked bars (Staffs.) f.o.t.				12	0	0
Gas strip	11	0	0 to	11	10	0
Bolts and nuts, ¾ in. × 4 in.				15	5	0
Steel—						
Ship plates	8	12	6 to	8	17	6
Boiler plts.				10	10	0
Chequer plts.				10	12	6
Angles				8	2	6
Tees				9	2	6
Joists				8	2	6
Rounds and squares, 3 in. to 5½ in.				9	2	6
Rounds under 3 in. to ¾ in. (Untested)				8	0	0
				and upwards		
Flats, over 5 in. wide and up				8	7	6
Flats, 5 in. to 1½ in.				7	17	6
Rails, heavy				8	10	0
Fishplates				12	10	0
Hoops (Staffs.)				10	10	0
Black sheets, 24g.	10	0	0 to	10	10	0
Galv.cor.shts., 24g.	13	2	6 to	13	15	0
Galv. fencing wire 8g. plain				12	0	0
Billets, soft	6	10	0 to	7	0	0
Billets, hard	7	12	6 to	8	2	6
Sheet bars	6	5	0 to	6	10	0
Tin bars	6	5	0 to	6	10	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/4
Sheet to 10 w.g.	1/5
Wire	1/6½
Rods	1/5
Tubes	1/9
Castings	1/4

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	10d. to 1/4
Rolled—	
To 9 in. wide	1/4 to 1/10
To 12 in. wide	1/4½ to 1/10½
To 15 in. wide	1/4½ to 1/10½
To 18 in. wide	1/5 to 1/11
To 21 in. wide	1/5½ to 1/11½
To 25 in. wide	1/6 to 2/-
Ingots for spoons and forks	10d. to 1/6½
Ingots rolled to spoon size	1/1 to 1/9½
Wire round—	
3/0 to 10 G.	1/7½ to 2/2½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	21.76
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	15.00
Basic	20.26
Bessemer	20.76
Malleable	20.76
Grey forge	19.76
Ferro-mang. 80% d/d	105.00
O.-h. rails, h'y at mill	43.00
Bess billets	34.00
O.-h. billets	34.00
O.-h. sheet bars	36.00
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.95
Tank plates	1.95
Beams, etc.	1.90
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.20
Sheets, black, No. 24	2.85
Sheets, galv., No. 24	3.60
Sheets, blue an'l'd, No. 13	2.35
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv.	3.30
Tinplates, 100 lb. box	$5.35

COKE (at ovens).

Welsh foundry	26/- to 30/-
,, furnace	21/- to 23/-
Durham and North.	
,, foundry	17/6 to 18/6
,, furnace	17/6 to 18/6
Midlands, foundry	—
,, furnace	19/- and up

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes	20×14 box	18/3
,,	28×20 ,,	36/6
,,	20×10 ,,	26/3
,,	18¾×14 ,,	18/9
C.W.	20×14 ,,	15/3
,,	28×20 ,,	33/6
,,	20×10 ,,	21/3
,,	18¾×14 ,,	16/-

Terneplates 28×20 .. 33/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0 to £7 10 0
Bars, hammered, basis	£17	10	0 to £18 10 0
Bars and nail-rods, rolled, basis	£15	15	0 to £16 15 0
Blooms	£10	0	0 to £12 0 0
Keg steel	£32	0	0 to £33 0 0
Faggot steel	£20	0	0 to £24 0 0
Bars and rods, dead soft, steel	£10	0	0 to £14 0 0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes.	*Fittings.*
Gas	67½%	50%
Water	63½%	45%
Steam	60%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
June	13 ..	76	2	6	inc.	30/–
„	14 ..	75	15	0	dec.	7/6
„	17 ..	75	2	6	„	12/6
„	18 ..	74	13	9	„	8/9
„	19 ..	73	7	6	„	26/3

Electrolytic Copper.

		£	s.	d.		
June	13 ..	84	5	0	No change	
„	14 ..	84	5	0	„	„
„	17 ..	84	5	0	„	„
„	18 ..	83	15	0	dec.	10/–
„	19 ..	83	15	0	No change	

Standard Tin (cash).

		£	s.	d.		
June	13 ..	198	7	6	dec.	40/–
„	14 ..	197	15	0	„	12/6
„	17 ..	201	0	0	inc.	65/–
„	18 ..	201	5	0	„	5/–
„	19 ..	201	10	0	„	5/–

Tin (English ingots).

		£	s.	d.		
June	13 ..	199	15	0	dec.	45/–
„	14 ..	199	5	0	„	10/–
„	17 ..	201	15	0	inc.	40/–
„	18 ..	201	15	0	No change	
„	19 ..	202	5	0	inc.	10/–

Zinc Sheets (English).

		£	s.	d.		
June	13 ..	35	0	0	No change	
„	14 ..	35	0	0	„	„
„	17 ..	35	0	0	„	„
„	18 ..	35	0	0	„	„
„	19 ..	35	0	0	„	„

Spelter (ordinary).

		£	s.	d.		
June	13 ..	26	3	9	No change	
„	14 ..	26	3	9	„	„
„	17 ..	26	1	3	dec.	2/6
„	18 ..	26	3	9	inc.	2/6
„	19 ..	26	2	6	dec.	1/3

Lead (English).

		£	s.	d.		
June	13 ..	25	0	0	No change	
„	14 ..	25	0	0	„	„
„	17 ..	25	0	0	„	„
„	18 ..	25	5	0	inc.	5/–
„	19 ..	25	5	0	No change	

Exports of Iron Castings in May and the five months 1929, compared with May and the five months 1928.

	May, 1928.	May, 1929.	Five months, 1928.	Five months, 1929.	May, 1928.	May, 1929.	Five months, 1928.	Five months, 1929.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
BUILDERS' CASTINGS—								
Stoves, Grates, etc., Cisterns, Baths, etc., and cooking and washing boilers—								
To Argentine Republic	160	337	706	1,024	8,068	15,408	29,494	47,852
„ British South Africa	222	495	1,530	1,711	8,812	17,178	53,997	60,062
„ „ India	82	198	689	821	3,227	7,521	29,957	31,612
„ Australia	49	41	290	304	3,254	3,183	20,252	18,698
„ New Zealand	117	169	863	646	6,072	6,186	42,366	42,817
„ Other countries	737	926	3,811	4,286	35,105	42,775	175,184	193,089
Total	1,367	2,166	7,889	8,792	64,538	92,251	351,250	394,130
PIPES AND FITTINGS—CAST—								
To Argentine Republic	627	1,119	3,693	12,881	6,310	10,484	38,782	124,256
„ British South Africa	871	1,258	2,302	3,421	13,928	15,397	35,981	43,468
„ „ India	563	418	4,277	1,756	7,663	4,151	53,403	25,686
„ Straits Settlements and Malay States	1,666	2,222	6,433	11,210	13,649	17,245	58,394	81,627
„ Ceylon	87	673	544	1,037	1,099	6,323	6,702	10,273
„ Australia	2,771	453	4,930	2,572	28,957	4,451	53,527	25,898
„ Other countries	5,512	6,187	25,805	25,804	63,256	85,997	341,057	310,592
Total	12,097	12,330	47,984	58,681	134,862	144,048	587,846	621,800
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	376	421	1,958	1,957	14,027	15,813	72,377	71,117
„ Enamelled	66	70	340	346	5,783	6,504	29,951	31,036
CASTINGS, in the rough—								
Iron	88	204	467	568	3,737	6,867	18,814	20,411
Steel	44	148	227	444	2,441	5,389	10,890	18,959

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

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Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-.

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

FOUNDRY MANAGER or FOREMAN; position desired; practical, technical, and metallurgical knowledge; general and high-class work; 17 years' experience as foreman; good references; moderate salary accepted; M.I.B.F. —Box 246, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY FOREMAN desires position; practical and technical training all branches iron and non-ferrous work; experienced on motor, engineering, and jobbing work; up to date on cupola and mixing of metals for all classes of castings; can guarantee results and production.—Box 230, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ASSISTANT FOUNDRY FOREMAN is required to take sole charge of the production of Light Castings by the latest modern methods. Full particulars of age, experience, achievements, and salary required, to be stated. —Box 240, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

EXPERIENCED LEDGER-CLERK required in old-established foundry in East Midlands; one in a position to introduce business preferred; investment £500; good return for services and capital to suitable applicant.—Box 250, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOREMAN required for aluminium foundry in London area; must have sound practical experience in modern methods of production.—Write full particulars, in confidence, to Box 248, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY.

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of SHOPPING,
Compact and Convenient.

SIDING CONNECTIONS
with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES
Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

A TRAFFORD PARK BARGAIN.—Modern Foundry with own railway sidings, excellent warehouse, packing room and fine offices, centrally heated, for SALE. Premises are all one storey and easily adaptable for other trades. Cost £20,000 in 1921. For a quick sale, owners will take £2,000, including two 4-ft. modern cupolas.—F. S. AIREY, ENTWISTLE & COMPANY, 10, Norfolk Street, Manchester.

FOUNDRY. — Opportunity occurs for acquiring whole or controlling interest in private Company owning large, modern, and exceptionally well-equipped Ferrous and Non-Ferrous Foundry near London. Large turnover and satisfactory profits. Now employing over 100. Every opportunity for closest investigation will be given to *bona-fide* purchasers. Principals only.—Apply, in first place, to MESSRS. ALLEN, EDWARDS & OLDFIELD, Solicitors, 3, Salters' Hall Court, Cannon Street, E.C.4.

MACHINERY.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. BREALEY & COMPANY, LIMITED, Prospect Works, Hawksley Avenue, Sheffield.

FOR SALE, 24 Hand-operated Adaptable Moulding Machines in equal-to-new condition, some of them only a few months old. We are selling because of recent installation of power-operated machines.—Apply, Box 244, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

DISMANTLING CAMPBELL GAS ENGINE WORKS, HALIFAX.

FOR SALE:—

Two Cupolas, each about 7 tons per hour, 32 ft. 0 in. high x 6 ft. 6 in. dia.; also Charging Platform and large quantity of Foundry Boxes, etc.

List on application to—
MR. WILLIAMS,
Campbell Gas Engine Works,
Halifax.

Four-throw RYDER Forging Hammer, centre to centre of blocks about 6½ in., blocks 2½ in. square.

GILDEMEISTER Vertical Milling Machine, overall size of table 4 ft. 1 in. x 14 in., 36 in. x 11½ in. x 15 in.

BIERNATZKI Vertical Milling Machine, working surface of table 52 in. x 16 in., 2½ in. dia. spindle, 36 in. x 12 in. x 16 in.

NEW "Blanchard Type" Heavy Duty Vertical Surface Grinding Machine, magnetic chuck 19½ in. dia.

VERTICAL COCHRAN LAND TYPE BOILER, for gas firing, 16 ft. 3 in. high x 7 ft. 6 in. dia., working pressure 80 lbs. per sq. in.

One VERTICAL COCHRAN BOILER, 11 ft. 3 in. high x 5 ft. 0 in. dia., re-insure 150 lbs. pressure.

(ASK FOR "ALBION" MACHINERY CATALOGUE.)

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

PATENTS AND TRADE MARKS.

PROTECT YOUR IDEAS.—Free, Advice and Handbook on patenting inventions and registering trade marks by Registered Agent with 43 years' experience.—KING'S PATENT AGENCY, LIMITED, 146A, Queen Victoria Street, E.C.4.

MISCELLANEOUS.

GANISTER, best quality, for cupolas, also for Steel Works.—ASTBURY SILICA COMPANY, "The Brooms," Park Lane, Congleton.

BRASSFOUNDRY RESIDUES. — Ashes, Skimmings, Grindings, Dust, bought for best prices; collected by lorry radius 30 miles London, or ex rail beyond.—Communications, KINRIX, 199-201, Warwick Road, London, W.14. 'Phone: Western 0273.

FOR SALE.—Du-Ram Patent Steel Moulding Boxes, as used by all the leading foundries. Perfect interchangeability and accuracy together with long life. Inquiries solicited. Quick deliveries.—J. W. SADLER & COMPANY, LIMITED, Bartle Lane, Great Horton, Bradford.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—CLEGHORN & COMPANY, Midland Pattern Works, Spring Gardens, Worcester. 'Phone 264.

PATTERNS OF ALL DESCRIPTIONS. LARGEST WORKS IN THE MIDLANDS. QUOTATIONS BY RETURN.
G. PERRY & SONS,
HIGHCROSS STREET, LEICESTER.

MISCELLANEOUS—*Continued.*

FLUORSPAR.—The ideal Flux for all Foundry and Furnace work; supplied in crude lump, washed gravel or finely ground. Samples and prices from

A. BECK,
MINEOWNER, MATLOCK.

CHARCOAL.—Powdered, granulated, lump, blacking; inquiries invited.—J. BUCHANAN & COMPANY, Ashfield Road, Altrincham, Cheshire.

FOUNDRY REQUISITES

Try our REFRACTORIES.

Ganister or Silica Bricks and Blocks (any shape or size) **Sands, Cements, Ganister.**—*Let us have your enquiries*

THE CLEVELAND MAGNESITE & REFRACTORY CO., LTD.
Normanby Brickworks, Normanby, Eston, Yorks

BAILEY'S
TRANSVERSE TESTER
FOR THE FOUNDRY.

Test Bars of Cast Iron, Bronze, Etc.

Testers for all Materials, Oils, etc.

Air Compressors, Pumps, Reducing Valves.

SIR W. H. BAILEY & CO., Ltd., Manchester.

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